

McDonough, James W.

UNITED STATES PATENT OFFICE.

Interference No. 17,403.

JAMES W. McDONOUGH

vs.

JOHN JOLY.

} Art of Producing Colored Pictures by the Aid of Photography.

McDONOUGH'S RECORD.

Banning & Banning & Sheridan,

Attorneys for McDonough.

EASTMAN BROS., LAW PRINTERS, 358 DEARBORN ST., CHICAGO.

U. S. National Museum

Section of Photography

3821



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U. S. National Museum
Section of Photography
No. 3821

IN THE
United States Patent Office.

INTERFERENCE No. 17,403.

JAMES W. McDONOUGH	}	Art of Producing Colored Pictures by the Aid of Photography.
vs.		
JOHN JOLY.		

Preliminary Statement of James W. McDonough.

STATE OF ILLINOIS, }
COUNTY OF COOK. } ss.

I, James W. McDonough, being duly sworn, on oath depose and say:

I am the James W. McDonough whose application, No. 533,198, filed December 28, 1894, is involved in the above interference. I have read and carefully considered the issues or statement of the interference as defined by the Office, and believe that I understand the same. I first conceived of the invention set forth in the declaration of interference as early as January 1, 1879. I never made any drawing of the invention until I was required to do so by the Office in the above application for a patent. I made what I suppose may be termed a model, showing the invention, as early as August 15, 1881. I explained or disclosed the invention to others as early as August 15, 1881. I reduced the invention to practice in

crude or experimental forms as early as August 15, 1881. The invention has never been put into public use or sale.

JAMES W. McDONOUGH.

Subscribed and sworn to before me this }
24th day of September, A. D. 1895. }

ANNIE C. COURTENAY,

[SEAL.]

Notary Public.

IN THE UNITED STATES PATENT OFFICE.

James W. McDonough	}	No. 17,403.
vs.		Subject:
John Joly.		"Photographing in Colors."

Testimony taken on behalf of McDonough this 10th day of December, 1895, before M. L. Price, Notary Public, pursuant to the annexed notice.

Present on behalf of McDonough, Thomas A. Banning, Esq., and on behalf of Joly, Frank L. Freeman, Esq.

JAMES W. McDONOUGH, a witness produced, sworn and examined on his own behalf, in answer to questions by Mr. Banning, deposed and testified as follows:

Q. 1. State your name, age, residence and occupation. A. Name, James W. McDonough; age, upwards of fifty; residence, Chicago, Illinois; and occupation, I have been an electrical engineer, but am now at work on my own inventions.

Q. 2. Are you the James W. McDonough whose application No. 533,198, filed December 28, 1894, is involved in this interference? A. I am.

Q. 3. The counts of this interference, as stated by the Examiner, are as follows:

“*Count I.* A screen or plate for photographic purposes, having on its surface colored particles arranged according to regular recurring patterns,—as dots, lines and figures.

“*Count II.* A screen or plate for photographic purposes, provided with different colored substances arranged according to regular recurring patterns,—as dots, lines, figures,—of such colors and proportions as to cause each to absorb such colors as are transmitted by each and all the others.

“*Count III.* In photography, the subdivision of the image by means of a screen on which are parallel lines ruled in several colors and in close juxtaposition, thereby producing compound color effects.”

Please state whether you have read and understand the subject-matter of this interference, as stated in the counts quoted above. A. I have read them and think I understand them.

Q. 3. Please state, as matter of inducement, how long ago it was that you began to direct your attention, more or less, to the subject of potographing in colors. A. It is quite thirty years ago, about 1865, that I began work on that subject.

Q. 4. Please state about when you conceived the idea of making a screen or plate for photographic purposes having on its surface colored particles arranged according to regular recurring patterns, as dots, lines, figures. A. It was some time during the year of 1878. I have placed the date, not knowing the exact time, as early as January 1, 1879.

Q. 5. Please state about when you conceived the idea of making a screen or plate for photographic purposes provided with different colored substances arranged according to regular recurring patterns, as dots, lines, figures, of such colors and proportions as to cause each

to absorb such colors as are transmitted by each and all the others. A. At the same time—that is, as early as January 1, 1879.

Q. 6. Please state about when you conceived the idea in photography of the subdivision of the image by means of a screen on which are parallel lines ruled in several colors, and in close juxtaposition, thereby producing compound color effects. A. Sometime in the year 1878, and previous to the 1st of January, 1879.

Q. 7. Please begin with the date you have mentioned—January 1, 1879—and proceed to state in consecutive order, as nearly as may be, what you did from that time to the time of filing your application and to the present time, if you desire, toward the practical embodiment or carrying out of these ideas. In answering this question, you may give in narrative form the history of your efforts, operations and results. A. As I said before, I have been working upon this subject since the year 1865. In 1878 I was in the furniture business, and my factory was at 390 South Canal street, Chicago. I had there, in the fourth story of that building, a work room, in which I carried on my experiments, and was working there upon colored photography, and there I had the conception as given in the counts of interference. My health was very poor at that time, and so poor that I was obliged during the latter part of the year 1878 to give up business.

I think it is necessary here to give some details of that sickness. I had a very serious form of neuræsthenia, and was taken home from my house on the South Side, and put to bed and slept nearly a month almost continuously, day and night. I had double vision; I could not walk straight; I had forgotten the multiplication table; I fell asleep on all occasions, in restaurants, in street cars; I ran into buildings; I had to be led about the street. I

won't go into any more particulars of that kind, but will say that I was confined to the house more or less for nearly three years. I had to learn to walk the second time. I have never recovered from that entirely, and I think nearly six months of every year since that time I have been obliged to suspend work almost entirely.

In the fall of 1880, while I was at home in Chicago, I began working again on colored photography, and towards the spring of 1881 I made some of these pictures by the use of lines, as well as in other ways.

In the spring of 1881 I went to Boston to attend the examination in the telephone interference cases, and while there I cross-examined Prof. Charles R. Cross in the telephone interference cases. During a moment of leisure I had a conversation with Prof. Cross in which I mentioned to him that I was working on this subject, and after giving him some idea of what it was, asked him to recommend to me some book bearing upon the subject, and amongst the books he spoke to me of was one called Rood's "Student's Text Book of Color," which I understood from him had just been published. Some time after that, and within six months afterwards, I purchased the book.

In that book, on page 279, is the following paragraph at the bottom of the page:

"There is, however, another lower degree of gradation which has a peculiar charm of its own, and is very precious in art and nature. The effect referred to takes place when different colors are placed side by side in lines or dots, and then viewed at such a distance that the blending is more or less accomplished by the eye of the beholder. Under these circumstances the tints mix on the retina, and produce new colours, which are identical with those that are obtained by the method of revolving disks."

And on page 139, another paragraph, commencing at the bottom of the page:

“ Another method of mixing coloured light seems to have been first definitely contrived by Mile in 1839, though it had been in practical use by artists a long time previously. We refer to the custom of placing a quantity of small dots of two colours very near each other, and allowing them to be blended by the eye placed at the proper distance. Mile traced fine lines of colour parallel to each other, the tints being alternated. The results obtained in this way are true mixtures of coloured light, and correspond to those above given. For instance, lines of cobalt-blue and chrome-yellow give a white or yellowish white, but no traces of green; emerald-green and vermilion furnish when treated in this way a dull yellow; ultramarine and vermilion, a rich red purple, etc. This method is almost the only practical one at the disposal of the artist whereby he can actually mix, not pigments, but masses of coloured light.”

Some time before the 1st of May, 1881, I became the electrician for a telephone company, whose headquarters were in New York City. Shortly after that, in the month of May, I think, 1881, I rented an office at No. 19 Park Place, New York City, and had an extra room which I had fitted up for photographic work. I had a dark room, tanks for washing and conveniences necessary for the taking of photographs. I worked there upon these methods—I mean to refer to the methods that we are talking about.

About the 1st of August, 1881, I had a man by the name of George J. Klein come to New York from Chicago in order that I might learn from him through example what he knew about practical photography. He came to New York about the 1st of August, 1881. He remained with me in New York City until about the 1st of September, 1881. He was with me about four weeks.

I showed him some of these pictures, and explained to him the methods by which they were taken. These were experimental pictures and very crude. At this time, and for several years afterwards, I was in the employment of the telephone company, and gave up what time I could spare from my other duties to photographic work.

In the early part of 1883 I became connected as general adviser and assistant to the president of an electric light company. About the 1st of May, 1883, I moved from 19 Park Place to Vanderwater street, and built there a room for experimental purposes. On the 22nd of June, 1883, the building took fire. On the upper floor was a plating factory, where they used large tanks of such acids and metal solutions as are necessary for their business. The three upper floors of the building were burned out. My apparatus, books, clothing, instruments, and whatever I had, were ruined. My books were in a state of mush, and my apparatus so damaged in every way as to be worthless. I practically lost almost everything that was there. At this time I was working for the electric light company. Their factory was in Hartford, Connecticut. My duties required me to be in Hartford more than in New York.

Some time in the winter of 1884 the telephone company for which I was working changed hands, and I was given an office in the Telegraph Building of the Bankers and Merchants Telegraph Company. I think the number was 69 and 71 Broadway. One of the privileges I had was a room, which I fitted up as a photographic work-room. I renewed my library, and I find a bill of books which I bought of D. Van Nostrand, 23 Murray street, New York City.

Amongst them are noted "1 Chevreul, Color," which refers to the book called on the title page "The Principles

of Harmony and Contrast of Colors. By M. E. Chevreul." Published in London, by George Bell & Sons, in 1883. This bill also includes "Le Conte on Sight," which refers to a book entitled "Sight," by Joseph Le Conte, published by Appletons in 1881. Another, "Lommel Nat. Light," which refers to a book entitled "The Nature of Light," by Eugene Lommel, published by the Appletons in 1884. "Vogel, Light and Photography," is also included in the bill, which refers to a book entitled "The Chemistry of Light and Photography," by Herman Vogel, published by Henry S. King & Co., London, in 1875. Another included in the bill is "Tyndall, Light and Elec.," which refers to a book entitled "Light and Electricity," by John Tyndall, published by the Appletons in 1883. Another one on this list is "Shellen on Spectral Analysis," which refers to a book entitled "Shellen's Spectrum Analysis," by H. Shellen, published by Longmans, Green & Co., London, and Scribner, Welford & Co., of New York, in 1872. One book which is on that bill is called "Abney's Photography," one referred to "Rood on Color," which refers to the book from which I made the quotations above. One "La Lumiere" is also on the list. The French name of this book is "La Lumiere, et Les Couleurs, par Amedee Guillemin." Nineteen volumes of the "Annual Sci. of Discovery," and numerous other books which I will not mention.

These books were bought to replace the books destroyed by the fire referred to, and were bought in February, March, April and May, 1884, as appears by the original bill in my hand, and from which I have read their titles.

Facing page 146 and 148 in the book referred to, "Chevreul on Color," are colored plates or pictures

showing the mixture of colors drawn in fine parallel lines. The context is an explanation of the same.

While I was at that office, Nos. 69-71 Broadway, as I remember the numbers, I was employed both by a telephone company and an electric light company, and was required to visit other cities and work in other towns. I did not have a great deal of time to devote to outside matters, as this photography was never a business with me, and I worked, when I did work, when I was not otherwise employed. I made pictures with these lines in parallel colors in my work-room at this place. Although this room was my own room, I had occasional visitors, and carried on some of my telephone experiments for the benefit of the telephone company. Among the visitors, I remember one holiday, the 22nd of February, Washington's birthday, 1885, that John A. Cabot, at that time of New York City, called on me and I showed him some of these pictures. I was in that building, I think, about a year, when a general catastrophe befell the telephone company, and I was obliged to remove my effects. I worked, as far as I could, with very small conveniences in my private room.

In the beginning of 1886 I spent a while in Princeton, New Jersey, working at the college buildings and in the photograph room of the physical laboratory. I had a conversation with Prof. Cyrus J. Brackett on this subject of colored photography. During the time that I have given as having been spent in New York City, I was always in poor health, and occasionally was obliged to give up my work and to return to Chicago, and towards the spring of 1887 I was so completely broken down that I was obliged to leave New York City. About that time I had an interview with Gen. Samuel A. Duncan upon my affairs, laying before him several of my inventions,

and he advised me to drop everything and make an application upon my photograph work. I find in my diary at that time a number of entries—or, say, about that time—referring to this photograph matter, consisting of suggestions for claims in a patent.

Recess for lunch.

In the beginning of the year 1887 I was working for a telephone company, which, as I understand, was controlled by the stockholders of the Postal Telegraph Company, and my office for the time being was at 187 Broadway, New York. In a back room, back of the office, I had a great many of my effects stored, and with them all of the apparatus pertaining to my photographic work, and when I was obliged to leave on account of continued ill health, I sent to Chicago about eight or ten boxes and three or four trunks, and left in this back room, as I remember, two dry goods boxes and two trunks, containing my electrical instruments, such as galvanometers, rheostats and other measuring instruments, some books, a lot of models which I had made for the telephone and electric light companies, a number of telephone sets that were given to me by telephone companies. I remember packing a small box of pictures and the results of experimental work in one of my large boxes. I thought I had sent that to Chicago. I left New York about the 1st of April—along about there—and came to Chicago, putting these ten or twelve boxes and packages in the basement at 5534 Cornell avenue, Chicago.

After I had been in Chicago about a month I thought I would put an application in the Patent Office, and as a beginning or a memorandum on the subject I made some entries in my diary, as referred to before lunch. I have kept a continuous diary since 1881. The entries re-

ferred to are under the date of Sunday, the 8th of May, 1887, beginning:

- "Very Warm.
- "Frank in Michigan.
- "Claims.
- "1. Modelled after Bell. Tel.
- "2. For placing side by side colors.
- "3. For all colors to make W.
- "4. Such as will match particular pictures.
- "5. Process.
- "6. Use of fresh gelatine.
- "7. Black backing with all col.
- "8. White backing with printed afterward in lines.
- "9. Glass for colors of spectrum.
- "10. Destruction of color absorbed.
- "Disclaimer and description of Albert's process under different glasses and printing.
- "Careful description of theory.
- "Diagrams of colors side by side.
- "Dif. bet. mixtures and hatching.
- "(Give authorities or quote?)
- "General description of process not giving pigments necessary?
- "Perhaps better? Glass &c.
- "Thin plates.
- "Use of gelatine for cover or underlayer of powders.
- "Colors ought to be of one size.
- "Transference to supports.
- "Second exposure for black back ground.
- "Glycerine.
- "Rays cut off by tumeric or erythrosin.
- "Other applications to follow.
- "Sifting by gelatine damp weather."

The above entries, as I stated before, was a set of abbreviated memoranda to guide me in drawing up a preliminary description of an application for photographs in colors, according to this process in question, and ten claims, such as I wished to write out and add. Claim No.

1 I intended to model after the celebrated fifth claim in Prof. Bell's telephone patent, for which I have a great admiration. Claim No. 2 was to guide me in modelling a claim which should specify that these colors used in making a screen should be placed side by side and not superposed. Claim 3 was for the selection of such colors, such as when laid side by side should present to the eye a mixture of light reflected or transmitted and necessary to make white. Claim 4 was intended as the foundation of a claim where less or different colors or such as had been used in particular pictures to be copied were placed upon the screen. Claim 5 was for a process claim. I cannot remember the exact idea I had in my mind. Seven was to be a claim for a plate in which after the colors had been brought up by development after exposure, and the silver in the plate changed to white by the use of bichloride of mercury, the back of the picture was to be blackened up with some opaque material or a piece of black paper laid against it. The eighth claim was for a white or opaque material upon which were printed lines in these alternate colors. Nine was for the use of glass to match the colors of the spectrum as nearly as possible, and to be placed upon the surface of the glass plate and melted into use for a screen. In explaining No. 10, I will have to refer to a property of colors of which I have not before spoken, and that is their destruction or fading out by light. A picture is made by the action of light when colors are destroyed by the action of light.

The next memorandum refers to what is called the "Albert Type Process." The process I refer to is that particular branch of the Albert process where from three to a dozen different negatives are made by the use of different colored screens placed before the camera, each one

of these negatives representing a different color in the object to be photographed. The picture is made by making a kind of colotype printing plate for each color, and printing these different colors in register, one over the other, or superposed. The colored picture is obtained this way: The colors used in these processes are arbitrary; from three to a dozen colors are used, and in all cases these colors are superposed. For instance, I will refer to an article in the Scientific American of July 9, 1881, which is for a similar process. The title of the article is "The Prospects and Present State of Photography in Natural Colors." I meant to draw a distinction between that process and mine. The line "Diagrams of colors side by side" referred to Patent Office drawings. The abbreviation "Dif. bet. mixtures and hatching" refers to the difference between a mixture of pigments and hatching, which is a technical name for placing lines or particles of color side by side. The memorandum "Rays cut off by tumeric or erythrosin" refers to screens placed before the camera for reducing the actinism of some colors. For instance, the blue rays act faster on almost all sensitive photographic plates than the red or yellow or green.

In the year 1887 I did some work in Chicago, but went to New York again in the service of the telephone company in October, and staid there about six months. During that time I did nothing about photography, being closely employed in the service of the telephone company.

I find in my diary, February 15th, 1887, the following entry:

"Did not go down town to-day.

"Working on photos."

On the 17th is the following entry:

“Did not go down town.

“Worked on photos all day.”

On February 20th is the following entry:

“Staid at home all day.

“Worked a little on photos.”

On the 24th is the following entry:

“Stayed at home all day.

“Lloyd called in the morning.”

On the 25th is the following entry:

“Eldred came to house at noon.

“Was not well enough to talk much.”

On the 27th is the following entry:

“Worked on photos.”

On March 6, 1887, is the following entry:

“Rainy, dark weather.

“Worked on photos, but lost everything I did.”

These entries show that I was at home a great part of the time, and that other parties called on me, the fact being that at that time I was hardly able to get out of the house, but was working on this photograph business in my room at the boarding-house.

On the 7th of April, 1888, I went back again to Chicago. Before that I had called at the office of R. G. Ingersoll, and was taken very sick in his office, and had to be given restoratives before I could get away. On the 7th of April I find this memorandum in my diary:

“Arrived in Chicago at 10 A. M. Met Frank at depot. Went to see Dr. Foster about my head.”

During the summer of 1888 I went into business in Chicago in the manufacture of a piano chair which I had patented a great many years before, and continued in this business until August, 1891, giving it my personal attention, and at that time sold out because my health was

not good enough to continue farther. I had my photographic apparatus during these years at 5534 Cornell avenue, Chicago, where I worked at odd times upon this process. In March, 1891, I made a draft for an application for a patent for this process at the request of Mr. T. A. Banning, and took it to him at his office. This draft was made as carefully as I knew how to make it at that time, and contained, besides the specification, a draft of two claims. It was made at my office, 413 Wabash avenue, on my business letter-heads or paper. I have the original, just as it was drawn by me and handed to Mr. Banning to prepare the application, which was sworn to March 10, 1891, and filed March 14, 1891. The original draft is as follows:

“At the present time there is in Photography a process by which three pictures or more are taken of an object each of which is impressed in the camera by a single primary color, means being taken to cut off the effect of other colors by colored screens and by the nature of the sensitive photographic film itself.

“From these three or more negatives printing plates are prepared from which a compound picture is printed mechanically, in which the separate colors are superposed to form a single picture in an approximate coloring or three colored transparencies are thrown superposed upon a screen by a lantern in the well known way.

“The process which is here described is one in which a single plate is made to perform the office of the three or more negatives used in the process described and which plate will in itself without further process of combination form either a positive or negative picture.

“I take a plain glass plate and flow it with a coat of varnish which will dry tacky. This plate I dust with a mixture of colors formed in the manner afterwards described. By this means I obtain a colored surface composed of particles laying side by side and

which have the properties of stippled colors and not of a true mixture of pigments.

"I use for colors glass powdered transparent pigments; gelatine, Rosin or shellac stained by aniline dyes &c. The glass colors after being dusted upon the surface of the glass plate may be melted into the body of the plate by fire.

"I will describe in more detail the preparation of a glass negative with shellac stained in colors.

"The plate may be flowed with a plain collodion to which is added a small quantity of glycerine so that when the collodion is dry it will remain tacky enough to retain the colored shellac dust in a single layer.

"I take a sufficient quantity of clean white shellac dissolved in alcohol to which I add aniline colors, say for one lot a red & yellow in such proportions that the result will be a red which when viewed by transmitted light in thin layers will cut off or absorb as much green, blue, violet and yellow as possible or in other words transmit a pure red.

"Another lot I color with as pure a green as may be formed by mixtures, adding yellow to absorb blue. Another lot is colored blue.

"For the reason that the mixtures of colors formed in this way by Red & Green do not form a bright yellow I may use in addition, a lot colored as near the yellow of the spectrum as possible.

"These lots are allowed to dry forming colored masses which are reduced to powder by grinding, sifting &c.

"Now if proper proportion of Red & Green are mixed a nearly black mass will be formed. And if proper proportions of the red, green, yellow & Blue a mass will be formed that is nearly black, but if this same mixture is dusted upon the prepared glass surface it will reflect or transmit a mixture of all these colors which will be white in proportion to the purity of color, cleanliness of mixture, and quantity of light transmitted or reflected. The glycerine may be washed out. When viewed under the microscope the white surface is seen to be composed of a multi-

tude of different colored particles laying side by side and separated by small distances.

“Two results are obtained by subjecting this plate to just sufficient heat to melt the shellac. The powders melt and fill the gaps, forming a surface which when viewed in the microscope resembles a window formed of a mosaic of small colored pieces each joining the other. If the heat is carried further the edges melt into each other and further mixtures of colors are obtained.

“2nd. The surface of the plate which before heating reflects all the colors and resembles the surface of ground glass or a white powder in what is termed a mat surface, becomes transparent by the flattening of the particles.

“This result may be obtained in a measure by coating the surface with varnish. A plate formed in this way upon any suitable material may be flowed or covered with such sensitive compounds as are used in taking photographs or an orthochromatic Dry plate may be rendered sticky and the mixture of colored dust brushed over it to form the plate.

“This last may be developed by the use of the so called alkaline-pyro developer so that the colored particles will adhere to the surface where penetrated by the same colored light and those which do not allow the passage of colored rays on account of absorption may be washed off. Thus blue rays will cause blue particles to remain as an image etc. etc. White light as to all the colored particles in that space acted upon by white light, and all will be removed where black occurs which does not act upon the photographic film. This picture may be used as a negative or backed by a black surface as in the ambrotype.

“When the sensitive film is either flowed over or transferred to the glass plate upon which the colors are attached, it may be exposed in the camera reversed or so that the image may act through the glass from the back and the gelatine & silver not acted upon by the pyro developer may be removed by hot water or a negative or positive formed by any of the well-known developers & processes. The photo-

graphic image in silver may be rendered either white or black by well-known processes.

“The colored image is formed by the reflection of light through the colored particles or by the transmission of light through them. These colors may be ruled in fine lines.

“The use of orthochromatic sensitive plates and colored screens before the camera for the purpose of sifting light and regulating the action of different colors upon the film is too well known to require explanation.

“What I believe to be novel and ask for a patent upon is plate for photographic use holding upon its surface a layer formed of different colored particles laying side by side and not superposed to form an opaque mixture.

“2nd. A photographic plate formed of a support of glass or suitable substance of any color, a layer of different colored particles and a film of sensitive photographic compound for the purpose described.

“3rd. What about a claim for lines?”

I took this draft to Mr. Banning’s office, and he used it to dictate from to a stenographer—I being seated by him, explaining the draft, etc. We were interrupted a number of times, and upon this draft are a number of check marks made with a pencil, which I believe were made by him at times when those interruptions occurred. The draft of the patent follows it pretty closely. Towards the end of the draft occurs these words:

“The colored image is formed by the reflection of light through the colored particles or by the transmission of light through them. These colors may be ruled in fine lines.”

After drafting the substance of a couple of claims, I put an inquiry as follows:

“What about a claim for lines?”

By agreement of counsel, the further taking of testimony is adjourned until Wednesday, December 11, 1895, at 10 o’clock A. M.

Wednesday, December 11th, 1895, 10 o'clock A. M. Met pursuant to adjournment. Present as before.

Answer continued:

I find in my diary the following entry, made on the 6th of March, 1891:

“Gave Banning Photo patent to put in Patent Office. Long talk with G. A. Douglas about photos in colors.”

This was the date upon which I gave Mr. Banning authority to proceed with my application, which was filed March 14, 1891.

I referred yesterday to Rood's Text Book on Color, and made some quotations from it in regard to the effect of placing fine lines or dots close together in colors. From the year 1865 until 1878 I had read everything that came under my eye in regard to the science of optics, and particularly in its relation to photography. I never separated the use of lines or dots from each other as equivalent manners of placing these colors upon the plate for photographic purposes. But when I came to draw this preliminary draft for the application, I drew another line. The distinction between a plate that was used for a picture in itself and general printing methods, where a separate positive picture is made, with other materials than that of the original plate. It was my intention to follow that patent by others, and the mass or body of the application made March 14, 1892, referred more generally to the making of single pictures, although upon that subject I make reference to the transference of the sensitive film to the plate and to the making or forming negatives or positives by any of the well-known developers and processes.

I made a very short reference in that draft of an application to ruled lines, and when, in going through the draft with Mr. Banning, we came upon that subject, I had a consultation with Mr. Banning as to the advisability of incorporating that part in the claims and specification. The result of our consultation was to omit reference to lines, and that for the ultimate purpose of making other applications. I expected to follow this shortly by the application which is the subject of this interference, but events did not shape themselves so that I felt that I was ready for it. We were required, even as it was, to divide that application into two parts, and in drawing up the second patent—a division of the first—I again called Mr. Banning's attention to the lines question, and as a result, wishing to avoid any mention of lines, and as Mr. Banning had told me that I could not obtain a patent including them, or a claim for them, we made the following sentence or explanation in the second division, known as "Patent 471,187, the Art of Producing Colored Photographs," issued the 22nd day of March, 1892, page 2, line 24:

"I will merely add that the particles are dusted, spread or placed upon the plate in such proportions as to produce a white or transparent surface."

In July, 1891, I sold out my business. In the winter of 1891-2 I spent several months in Florida and Cuba. These patents referred to as divided were issued March 22, 1892, while I was in Florida. I arrived in Chicago about the middle of April. About the 25th of April I wrote a letter to Professor Charles R. Cross, Massachusetts Institute of Technology, Boston, Massachusetts. I find in my diary of Saturday, April 23, 1892, the following entry:

"Gave copy of letter to photo material dealers to Douglass & Shuah."

This letter was sent to a number of persons with a slightly different preliminary statement at the beginning. It was sent to E. & H. T. Anthony & Co., 591 Broadway, New York; M. A. Seed Dry Plate Company, St. Louis; G. Kramer Dry Plate Company, St. Louis; Carbutt Dry Plate Company, Philadelphia; George T. Green, Rockford, Illinois; Dr. Charles Ehrman, 423 Broome street, New York; W. H. Sherman, Milwaukee; Professor Charles R. Cross, Massachusetts School of Technology, Boston, Massachusetts; Professor C. J. Brackett, Princeton College, New Jersey; Professor C. B. Thwing, Northwestern University, Evanston, Illinois. I gave the copy to Gayton A. Douglass, of Chicago, and he gave me a number of the addresses of those to whom I sent them. These names I find in my diary of Tuesday, the 26th of April, 1892.

The letter to Professor Cross, and they are all alike as to the body of the letter, is as follows:

“CHICAGO, April 25, 1892.

“PROF. CHARLES R. CROSS,

“Massachusetts Inst. of Technology,

“Boston, Mass.

“*Dear Sir:* About ten years ago at the time you were being cross-examined in Boston on the telephone case, I told you I had accomplished something in photography in colors. I have waited until I thought the time was ripe for publication. I asked you, if you will remember, for the name of some authority on color, and you told me you thought ‘Rood’s Text-Book on Color’ was what I wanted. I send some extracts only to prove that I found there ‘authority’ to quote.

“I send you copies of two patents recently issued to me. I think them to repay the reading. They are for processes that are practical, and which involve the use of but one plate and one camera, and may be developed with materials in common use by photographers to-day. A correct picture is either obtained

in the natural colors of the object through development alone. The method is thoroughly scientific, and is so simple as to be understood by any one having a rudimentary knowledge of the science of optics. The colors used are not exactly those represented here, but are matched as nearly as I have been able, with the pieces of tissue paper here attached."

[Here are attached in the letter four pieces of tissue paper—one red, one yellow, one green and one blue.]

"The use of the yellow, which should be a little more orange than the sample, is a matter of choice. It is explained in the patent specification. In case it is not used, the yellow must be added to the green and red, making, as near as may be expressed, ultramarine, vermilion and emerald green. These colors, from three to nine in number, when mixed, give a white which answers practical purposes. The blacks and shades may be formed or put on by backing with black, or any dark color, as in the old ambrotype. The processes are not limited to making positives, but contemplate negatives or transparencies, and the use of glass, celluloid, paper or any material in use. The focus of the camera must be altered for the red, and as the red rays are slow with some isochromatic plates, it is advisable, perhaps, to use a screen for the red, made by flowing a piece of ruby glass with, say aurantium and collodion on one side. A notch may be made to denote the focusing point, but I do not think it necessary to add any advice on these points, and I hesitate even to send the colored papers. I think one would have more original success without these or anything in the shape of samples. My preference is for the special process, where the colors are melted or rolled upon the glass or celluloid plate, and the sensitive isochromatic emulsion flowed over it, the exposure taking place through the plate. I have emulsions mixed with fine white powders of chemically inert substances, which, when the part unacted upon by the light and developer, are removed by hot water, leaves on the plate a white positive, which reenforces the colors to

a wonderful extent. This may be flowed or painted over with a black or dark violet varnished to give the blacks and shades, and neutralize any tendency towards stain in the film. I have also removed the glass colors with hydrofluoric acid where unacted upon. I have found some lots of plates to become insoluble more readily than others where acted upon by pyro-developer, and some developers to act more readily than others. This effect is increased by time; a plate laid away for an hour or more becomes more insoluble and better results are often obtained. I, of course, cannot attempt to instruct in technical manipulation by letter.

“The firm of J. R. Alsing & Co., of 117 Pearl street, New York City, make the Alsing patent pulverizing cylinder, which will grind gelatine or any substance fine enough for the purpose. I will add that the firm of William Pickhardt & Kutroff are the New York and Chicago agents of the Badische Farben Gasellschaft, of Bavaria, Germany, who have a list of five thousand analine and kindred colors, from which almost any selection may be made, taking care to obtain such as are not incompatible with the chemicals used in the development or fixing, or the proper heat necessary for preparation of plates. If there are any points in the patent specifications not understood, I shall be happy to give further explanations.

“I shall be happy to hear from you,

“Yours truly.”

The extracts attached to the letters are as follows:

“EXTRACTS FROM ROOD’S TEXT-BOOK ON COLOR.

“*Theory of Fundamental Colors.*

“Page 120.

“In order to give more exactness to this theory, (Young’s), it is necessary to define with some degree of accuracy the three fundamental colors: For there is a great variety of reds, greens and violets. Helmholtz, as the result of his first investigation, selected a red not far from the end of the spectrum, a full green and violet; in other words, the tints chosen were the middle and end colors of the spectrum.

Maxwell, who made a series of beautiful researches on points connected with Young's theory, was led to adopt as the fundamental colors a red which in the spectrum lies between the fixed lines C and D, and is distant from C just one-third of the distance between C and D. This is a scarlet red, with a tint of orange, and is represented by some varieties of vermillion. His green is situated between E and F, being distant from E by one-quarter of the distance between E and F. This color finds among pigments an approximate representative in emerald-green. Instead of adopting a full violet, Maxwell selected a violet-blue midway between the lines F and G, which is represented tolerably by ultramarine-blue. By subjecting the results of experiments on the spectrum to calculation, it is possible to fix on the position of one of the fundamental colors, viz., the green. Thus Charles S. Pierce, using data given in Maxwell's paper, obtain for this color a slightly different result from that just mentioned. According to his calculations, the fundamental green has a wave length of 524 ten millionths of a millimeter and is situated between the lines E and b , being one-third of the distance E b from E, whereas Maxwell's green is just beyond b . J. J. Muller, who conducted an important investigation on this subject by quite a different method, arrived at a somewhat different result for the position of the green, and assigned to it a wave length of 506.3 ten millionths of a millimetre. This position in the spectrum is nearer the blue than the positions given by Maxwell and Pierce, and the tint is more of a bluish green. Again, Von Bezold, basing his calculations on the experimental results of Helmholtz and J. J. Muller, reached a conclusion not differing much from those of Maxwell and Pierce. He selects a green in the middle of the normal spectrum between E and b , but nearer b . None of these results vary greatly; in fact, the difference can hardly be well indicated in a spectrum the size of this page. All these greens may be imitated by using pigment known as emerald-green, alone, or mixed either with a small quantity of chrome-yellow, or cobalt-blue, etc., etc., etc.

*“Complementary Colors.**“Page 130.*

“In the cases which remain, however, the effect of the mixture is not the production of colored, but of white light, thus:

“Table V.

“Red and bluish green gave	white.
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“Orange and Siam blue gave	white.
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“Yellow and ultramarine gave	white.
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“Greenish-yellow and violet gave	white.
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. . . . Green finds no simple complementary color in the spectrum; it requires a mixture of red and violet or the color called purple, etc., etc.

*“Mixtures of Colors by Means of Revolving Disks.**“See Chapters IX and X.**“Colors of Mixed Lights Produced by Lines or Dots.**“Page 279.*

“There is, however, another lower degree of gradation which has a peculiar charm of its own, and is very precious in art and nature. The effect referred to takes place when different colors are placed side by side in lines or dots and then viewed at such a distance that the blending is more or less accomplished by the eye of the beholder. Under these circumstances the tints mix on the retina, and produce new colors, which are identical with those which are obtained by the method of revolving disks, etc., etc.

“Page 139.

“Another method of mixing colored light seems to have been first definitely contrived by Mile in 1839, though it had been in practical use by artists a long time previously. We refer to the custom of placing a quantity of small dots of two colors very near each other, and allowing them to be blended by the eye placed at a proper distance. Mile traced fine lines of color parallel to each other, the tints

being alternated. The results obtained in this way are true mixtures of colored light, and correspond with those above given. For instance, lines of cobalt-blue and chrome-yellow give a white or yellowish-white, but no trace of green; emerald-green and vermilion furnish, when treated in this way, a dull yellow; ultramarine and vermilion a rich purple, etc. This method is almost the only practical one at the disposal of the artist, whereby he can actually mix, not pigments but masses of colored light.

“Page 282.

“This same method of mixing colors on the retina of the observer is also used more or less in oil painting with excellent effects; it lends to them a magical charm, the tints seeming purer and more varying; the very fact that the appearance of a painting changes somewhat, according as the observer advances or retires from it, being an advantage communicating to it, as we might say, a certain kind of life. . . . In water-color drawings the same mode of working is constantly employed under the form of stippling, more or less formal; and with its aid certain results of transparency and richness can be obtained, etc., etc.”

With these twelve or more letters were sent to each person a copy of the two patents referred to, both issued March 22, 1892.

The object of the letters was to introduce the patents. The object of the extracts from Rood's Text Book on Color was to place the name and position of the fundamental colors according to Young's theory, to explain the mixture of colors by lines or dots as being mixtures of light and not pigments, and to show the equivalency of lines or dots in these mixtures of light. I might have written these things in my own language, but thought it better to make direct quotations from well-known authorities. A quotation from the letter that I specifically call attention to, is:

“ My preference is for the special process where the colors are melted or rolled upon the glass or celluloid plate, and a sensitive isochromatic emulsion flowed over it, the exposure taking place through the plate.”

The word “isochromatic” is equivalent to “orthochromatic.” Where the colors are melted they flatten down upon the plate and fill up the interstices. “Rolled upon the glass or celluloid plate” refers to a machine made for rolling these lines upon a plate.

I received five answers to these letters, and was in communication with Mr. Gayton A. Douglass, to whom I gave a copy of the same.

I had never applied this process, to my recollection, to the commercial printing press. Before the 15th of May, 1892, I went to a man in the city of Chicago by the name of William Bertram, and had him make me what is called a “ruled tint,” as it is called in the trade. This was a piece of type metal mounted upon a wooden block and ruled lengthways in fine lines, 100 to the inch. This block was about two by four inches on the plane surface, and was made on an engraving or ruling machine, and when printed from with ink gave a fine plain ruled tint. This block I took to a printer. The name of the company was The Panorama Printing Company, 50 Hubbard Court, in the city of Chicago, and we printed from this block upon paper and celluloid about fifty sheets of cardboard in three colors, red, green and blue, so that the lines laid along side of each other to fill up the entire space of the rulings, making 300 lines to the inch. We also ruled celluloid upon which was a coating of gelatine with this block in three colors, red, green and blue. The inks with which these were printed were specially prepared by myself. They were spectroscopically tested for

color, and were made by dissolving mixtures of aniline dyes in glycerine. The red was formed from a mixture of an aniline red and orange; the green was a mixture of commercial green and yellow; the blue was a commercial aniline dye. If I recollect, I had about a dozen celluloid screens painted in these colors. I was with Mr. T. W. Roberts, Jr., who did the printing. I have the bill here for that work, dated May 16, 1892. It is the original bill, made at that time, on the 16th of May, 1892. I will add that I went to him again and had more work done from a different plate, and have a bill December 23rd, 1893, which is also an original bill, made out at the time of payment.

Out of this lot of fifty pieces of printed paper, I think there were about eight or ten that were very good. The balance were off register. Of the celluloid screens, there were perhaps three or four that were fit for use. Those screens and papers were used up in the course of work with them. I used the screens in my camera for taking a negative of an object made by placing slips or pieces of colored tissue paper upon a flat board. These tissue papers made a kind of artificial spectrum. They were red, orange, yellow, blue, green, violet, placed consecutively in a row. This was within a few days of the date of the bill of May 16th, 1892.

From this negative I made a positive picture by placing the negative over a sensitized plate and printing through by artificial light. This positive was developed and cut out, forming a transparency. This transparency was laid over one of the paper slips, upon which were the ruled lines corresponding to the screen, thus forming a picture of the colored object photographed. I have here a small screen made since that time and mounted upon a piece of glass for its preservation, and a small strip of paper ruled

with corresponding lines, also mounted upon a piece of glass for its preservation. This screen and paper are in approximately the same colors as those printed by The Panorama Printing Company, and about the same size. I made this to represent what I had at that time, to be used as an exhibit.

This printing block I took back to William Bertram in 1893—some time in the month of December. I went to Mr. Bertram to have a larger block finished, and left this there at the time I took the other block away. Some one in his place used it as a trying block, and scratched the surface over with another tool, except a part of it—there are several parts which can be seen.

This manner of printing did not suit me, as I thought I might obtain a more perfect printing block, and I placed a screen and block of paper in my pocket and went out to see what I could get better for a printing block. I remember that I took a screen and piece of paper to 138 La Salle street, and showed it to my brother-in-law, Frank L. Eastman, and, laying the transfer screen upon the ruled piece of paper, drew his attention to a play or changing of colors when the screen is shifted over the face of the paper. It is something to attract attention. This was perhaps a month after I received the screens and paper from the printer—that is, May, 1892.

I took this screen and paper to the workshop of A. Maas, and showed him the block of paper, telling him what it was for—that is, for the making of colored photographs, and asking him if he had a single-line Levy screen. This screen I wanted to use to make an engraving plate from in lines, by that means taking advantage of the very fine lines engraved by a very fine machine. These plates I intended to use on a printing press.

This visit to Maas took place before the last of August,

1892. I did not get a Levy screen from him; he had no single-line Levy screen, but I afterward got one of the Levy screens.

About the 1st of June, 1893, I moved my apparatus, books and dry-goods boxes full of instruments, apparatus, etc., to 91 Dearborn street, Chicago, an office building. There I had fitted up a dark room and operating room outside of my office, for the purpose of carrying on this same business of photographing in colors. I have a great deal of stuff. I had three rooms there and they were pretty well filled up. At my place at Cornell avenue I had had constructed a dark room, etc., and when I moved I tore out all the partitions and the dark room and packed my effects in dry-goods and other boxes and trunks for removal. I had packed on the floor and on shelves and in boxes a great amount of experimental stuff—plates and glass pictures, spoiled negatives and a general lot of trash, such as one would collect in the course of years, and I had this stuff swept up and thrown into barrels and carted off and dumped. This was dumped at some dumping place, I don't know where. I moved my apparatus and material, books, etc., to my new place, 91 Dearborn street.

On the 20th of September, 1893, I bought a ruling machine of the Fuchs & Lang Manufacturing Company. I have the original bill here, dated September 20th, 1893.

Recess for lunch.

The printing that I have referred to as being done in December, 1893, by the Panorama Printing Company was done from an electrotype made from the larger plates that I have referred to as having been made by William Bertram. I have the original plate and electrotype.

They were both made before the date of the printing, December 23, 1893.

The ruling machine which I referred to before recess as having been bought of the Fuchs & Lang Manufacturing Company I have here. It was a second-hand machine, in very good shape, and I took it immediately after buying it, September 20, 1893, to the factory of the Nutting Electric Manufacturing Company, to have some missing parts supplied, and there was added to it the wooden blocks upon which it stands and four or five clamps for holding a gang of ruling pens. These clamps I have. They were made of wood, with a steel pin, for the purpose of fitting into the ruling machine. I also had a steel point made for ruling upon glass. While at the factory of the Nutting Electric Manufacturing Company, to try the machine, I ruled a number of sheets of paper and gelatine in three colors. These gelatine sheets were transparent and of material used by lithographers for tracing upon, for transfer work. They absorb readily aniline inks. There were present when I did this work William H. Foulke, Samuel A. Nutting, Frank Luce and perhaps a dozen workmen in the same room. These gelatine sheets formed colored screens to be used in the camera for the purposes described in the application now pending in interference. This ruling was done within three days after the machine was taken to that factory. I took this machine to my rooms at 91 Dearborn street immediately after that. I used this machine with a number of different appliances connected with this photographic work.

In the month of September, 1882, I made a ruling machine for ruling paper or other material. I borrowed a phonograph. These phonographs were made with a rotating cylinder. This cylinder revolved upon a shaft

upon which a thread was cut. When the cylinder was rotated, it advanced from one end to the other by means of a screw. It had an attachment consisting of a diaphragm mounted in a holder, and to this diaphragm was attached a fine stylus for making indentations upon tin foil wrapped around the cylinder. In place of this stylus was substituted a holder for a pen. When this pen was supplied with ink and adjusted to rest upon a piece of paper or other material wrapped around the cylinder and the handle turned, a fine line was traced over the surface of the paper and continued in parallel lines until the paper was covered. This line became a parallel second line, with spaces between them. A second set of lines and a third set of lines could be ruled between them, parallel to the others. I ruled up paper, etc., with this machine, but I had great difficulty in doing it, because it was impossible to me at that time to get a regular line of equal width and density. I could not rule a line of equal density from one end of the sheet of paper to the other, and all my experience with ruling machines has not given me a set of lines sufficiently accurate for any commercial purpose. A steel pen would wear out and change its shape before running over a sheet of paper, say, six inches by fifteen in size.

When I had removed this ruling machine which I bought from the Fuchs & Lang Manufacturing Company, September 20, 1893, I commenced a series of experiments for the purpose of making some device that would remedy the defects of my former ruling machine.

I will say that this ruling machine made in 1882 was made by Paul Hoenack, New York City, and after the experiments made with it, the phonograph was returned to the owner, who was, I believe, Frank L. Pope, of New York City. I had made an appliance for holding ordin-

ary writing pens, which was made of a pen-holder with a little piece of steel rod riveted into the pen-holder and held at right angles, and which fitted into the ruling machine. I afterwards had the steel rod removed and another appliance put on to fit another machine. I also used, in connection with this machine, what is called a "ruling pen," made with two marking points, which might be adjusted backwards and forwards, and, in other words, an ordinary ruling pen, such as is used by draftsmen. No form of ruling pen that I tried, and I bought everything I could hear of, would make a line sufficiently accurate for my purposes. Steel pens would not last and retain their shape while ruling from one end of a sheet to the other. They would pick up dust or little imperfections and drag them across the sheet, and they would scratch the material, and to rule a line one-three-hundredth of an inch in width required to be very fine. They would not pass the ink, as a single particle of dust or adulteration of the ink would clog up a space probably a six-hundredth of an inch in width. I tried a glass pen, but it was too brittle to last. I flowed colored material made of gelatine and aniline inks incorporated over sheets of glass and scratched lines on them with a steel point. One other operation performed by this ruling machine was scratching the surface of a silver plate off in fine lines, and using it as an opaque screen with fine lines, using it with several glass plates placed in the front of a lens of a camera, thus forming a kind of compound screen.

With pens I had attained no satisfactory results, and I commenced with a different kind of ruling pen, which was a contrivance made to hold a small roller, with an apparatus for feeding the roller with ink. This was made some time in the winter of 1893-4. I have stated that

these ruling pens would not rule a line sufficiently accurate for commercial purposes. Nevertheless I ruled a number of screens with them, and used them in the camera to make pictures. I made screens by flowing glass with a sensitized solution of albumen and gelatine, exposing them to the light through a plain ruled screen, and washing out the parts not affected by the light, dyed the portion remaining upon the glass surface, and by means of the use of mica flowed with gelatine, built up screens by placing two separate screens upon a third to register.

I wish to say also that I have never discontinued my work upon the multi-colored screens formed by depositing flakes in a promiscuous manner upon a transparent plate; but I will not enumerate the different devices, etc., employed in effecting the manufacture of the multi-colored plates with promiscuous dots. This work was carried on off and on during the same time, both the making of the ruled or lined screens and the dotted screens.

I have already mentioned the electrotpe plate made and printed from about the 23rd of December, 1893.

From the Hotel Marlborough, New York City, I wrote a letter dated February 19, 1894, to the Heliotype Printing Company, 211 Tremont street, Boston, of which the following is a copy:

“HOTEL MARLBOROUGH,
“NEW YORK CITY, February 19, 1894.
“HELIOTYPE PRINTING CO.,
“211, Tremont Street,
“Boston.

“*Dear Sir:*—I have been acquainted with Col. V. M. Wilcox, of E. & H. T. Anthony & Co., for ten years or more. Mr. Harrison gave me the name of Mr. Scandlin.

“I wish to call your attention to two patents which were issued to me March 22, '92, Nos. 471,-

186 and 471,187, under the title of Improvements in the Art of Producing Colored Photographs.

“Every one to whom I have explained this process has been greatly interested.

“I intended to go to Boston, but cannot at present. I am not in good health and am going to Florida for the balance of the winter. My address will be Tarpon Springs, Fla. Please get a copy of each of these patents, if you have them not already. They will cost ten cents each with coupons.

“You will find in No. 471,186, the following claim as the third:

“‘3. A plate for photographic purposes having upon its surface a layer of different colored particles, lying side by side, and in such proportions as to produce a white or light colored transparent surface, to which may be applied a sensitive compound, substantially as . . .’ &c.

“This is a kind of compound screen which may be placed permanently in the camera plate holder against which the isochromatic dry film or plate may be placed or applied.

“The general object is to produce three color work with one plate, one lens and one exposure, and to place it in the hands of the ordinary photographer.

“I take it for granted that you will understand and fill in what I do not explain as written explanations are very difficult for me. Please keep in mind what are sometimes known as the Kurtz and the Ives processes. This screen described in claim 3, may be formed by taking a sheet of gelatine or gelatine attached to a sheet of celluloid or glass and printing upon it in a printing press, with inks composed of glycerine and analine colors, of which there are in the market over five thousand. I print with a ruled zinc plate of 125 lines to the inch. The impressions may be continued until any degree of intensity of each color is formed as the gelatine takes up the ink which is something in the nature of hektograph ink. The plate is printed in colors after this manner.”

[Here follows illustration formed by a number of lines about one-quarter of an inch wide crossing each other, formed of red, yellow and blue colors so

arranged that the red and blue are side by side and alternate, and crossed by a set of yellow lines at right angles, forming groups of dots composed of red, orange, green and blue, each dot being about a quarter of an inch square, and the whole occupying about three inches square.]

"This picture is a rough illustration made with ordinary water colors.

"You will notice the repetition of groups of four colors in such proportions to form whites or neutralize each other, red orange green and blue.

"When printed in lines as fine as 125 to the inch, this screen will show no color but will be a neutral tint when the colors are in proper proportions. The red ink I have made with a mixture of erythrosin and fast yellow O. The blue, methylin or Victoria blue. The yellow, chinoline yellow or auramine. Dissolved in alcohol before incorporating with the glycerine and the alcohol evaporated. The patent is not for any particular way of getting the particles on the screen. I use with this screen in the plate holder another colored plate or screen for the purpose of cutting down the rapid action of the more refrangible rays. The most perfect results have come from a medium ruby screen and rapid (say Cramer's crown) plates bathed in cyanide and ammonia solutions. Large chart like the picture will appear on the negative like an even surface (that is a perfect chart, the picture is not a success as it has washed).

"A negative is obtained from an exposure through these screens.

"I wish to give an idea as to two methods of making prints.

"Any number of transparencies or prints may be made from the negative, as from any negative.

"Paper or sheets of gelatine or celluloid may be printed in quantities exactly like the screen except in lighter tints if desired.

"The transparency is fitted over one of these *fac simile* sheets and the colors of the object show through. The other colors are either shaded down or covered entirely.

“I hope you will understand this with the aid of the patents. The screens and sheets of gelatine or paper *fac similes* can be sold prepared.

“Another method is a kind of hektograph. A transparency or swelled printing surface is formed upon which is transferred or printed a *fac simile* of the screen, and printed *from* upon white paper. This forms a picture like the Kurtz three color work.

“The hektograph transfer paper is made of gelatine, glycerine, sulphate of berium and printed with the glycerine colors. These processes are not claimed specifically but generally. The idea being the screen with colored particles which selects the colored lights and general photographic processes (patent 471,186, page 2, lines 10-14), for obtaining prints in colors by either using the screen itself or a duplicate, and two general processes which are described, and any other which may be thought of.

“I think this may be made a commercial success.

“I hope I have made some kind of explanation. If you are interested I will write further.

“Yours truly,

“JAMES W. McDONOUGH,

“Tarpin Springs,

“Florida.

“In care of

“FRANK L. EASTMAN,

“138 La Salle Street,

“Chicago.”

When I copied the page containing the diagram of a multi-colored screen, I found that the water used in copying this sheet had blurred the colors of the diagram, and before copying the next page I added in parenthesis the words “that is a perfect chart, the picture is not a success as it has washed.” After placing this in parenthesis I copied it in my book. In this letter is pretty fully explained the method of making transparencies in one number of one object from one negative, by the use of screens printed in lines so as to form regular groups or patterns of colors, and another process for printing

upon paper. The above letter was copied from my press copy-book. The original was mailed to the parties to whom it was addressed. I received a reply to this letter from the Heliotype Printing Company, of Boston, Massachusetts, dated February 21, 1894, in which they state "We do not feel at this moment that it will be of a commercial advantage to us in our business." I have the letter here and the whole of it may be copied if counsel desire.

I replied to their letter as follows:

"TARPON SPRINGS, FLA.,
"March 3d, 1894.

"THE HELIOTYPE PRINTING CO.,
"211 Tremont Street,
"Boston.

"*Dear Sirs:* Yours of 21st Feb. I have just received. I did not expect my process would aid you in your particular business, but that it might become a separate branch or new business for some party.

"The patents describe processes which are attractive and easier to grasp than those which may prove to be commercial, but one can make but a single picture from each exposure and therefore they are not to be thought profitable.

"The idea should be, as described in my former letter, to improve a process which may be used to produce any number from one negative, and which may be placed wherever there may be a kodak or ordinary photographer or small commercial house. And my object in addressing you was to interest parties who had fine presses in actual work on three color work or similar processes.

"The screens which may be made by ruling glass or etching it, or ruling or printing upon gelatine, may be sold as are other glass screens and at a price from five or ten to three hundred dollars.

"The hektograph paper may be printed and sold cheap enough and still afford a constant profit. The color in the swelled negatives may be washed out and

the negative preserved for future use or printed from by any ordinary process.

“I am pleased to see that you are interested in the thing and have sent for the patents.

“Yours truly,

“JAMES W. McDONOUGH.

“W. I. Scandlin.”

The above letter is copied from my press copying book. The original was mailed to the parties to whom it is addressed and I do not have it.

By agreement of counsel the further taking of testimony is adjourned until Thursday, December 12th, 1895, at 10 o'clock A. M.

Thursday, December 12, 1895. Ten o'clock A. M.
Met pursuant to adjournment. Present as before.
Answer continued:

This last letter seems to refer to a particular hektograph process for printing photographs in colors, the details of which were given in my letter of the 19th of February, 1894, and was for a process which might be worked by an ordinary photographer without the use of cumbrous machinery, in which they might buy screens and hektograph plates made as described, and be sufficiently improved to be put upon the market. It says the screens may be made by ruling glass or etching or ruling or printing on gelatine. I do not remember any answer to this letter.

In May, 1894, after I had returned from Florida, I had made a press for printing these lines and pictures mechanically. It was made by E. A. Delano, 53 and 55 South Jefferson street, Chicago. I have it here. The bill for the press forms I have here. It is dated May 7, 1894. Some time during the month of April, 1894, I moved my effects—that is, my photographic apparatus, materials,

etc.—for photographing to the Manhattan Building, where I am at present.

I have spoken of a small exhibit made of brass, which looks like a little wheelbarrow. It contains a little roller with a sharp edge. I began experimenting with this form of a rolling or ruling machine, which should contain this ruler as the immediate means for ruling. That machine I have worked on in one shape or another to the present time. I think the duplicated pieces would make two entire machines, with some left over. At the present time I can rule upon a sheet of mica flowed with gelatine three or six hundred lines to the inch. I will show one of the screens made on that machine. It is about 5 x 8 inches in size. It is not a perfect screen. It has a crease through the mica, and some imperfections on it, and I have not tested it, but it is such as we use in making photographs.

I wish to introduce two transparencies made at my place here. These have metal frames on. The negatives for these pictures were made this fall by one of my workmen near the City of Madison, Indiana. They were made with one of my screens; made under my direction and in my workshop. The pictures were put together here recently, and were made for an exhibit in this case. The materials used are ordinary commercial plates, and they are not flat. For that reason they are slightly out of register, and must be held in a certain position to get the proper color effect. These pictures are made from a black and white positive, and a line-screen ruled on mica. One is a scene showing a gate with two stone posts, a country road, two men standing by the posts. It shows some very handsome autumn foliage and leaves on the ground. The other one shows two men lying down, one

holding an American flag, which he moved slightly, and the foliage of the trees in the background.

I wish to introduce another picture made upon paper. It is a copy of a chromo. The colors are approximately true. This picture was made by making a negative of the object through a line-screen placed in the camera. A piece of sensitive paper, such as is used for photographic printing, was ruled in red, green and blue to match in register the screen. This paper was placed in the printing frame and registered with the negative and printed in the sunlight. It was taken out and placed in a toning bath to tone, as the ordinary photograph. I wish to say in regard to these colors here employed that they are not the same in composition as those used in the screen. When these colors are placed in a bath they are changed by chemical action, and the result is a different set of colors from those ruled onto the paper originally. Two of these colors are not on the market for sale. They are of my own composition. With another kind of bath, another set of colors would be necessary. I wish to say that I have experimented with aniline colors and those of kindred nature for fifteen or twenty years. I suppose I have worked with 500 different samples bought in New York City and Chicago; I have had colors imported for me. The greater part of aniline colors are exceedingly fugitive. Some of them may be used to print from a negative; some of them are so sensitive to the action of light that they are used for sensitizing rapid plates for producing the negative. I have found this fugitiveness of these colors a very great drawback, and it is only within a short time that I have concocted colors which I am assured will stand the light. All of my former pictures faded out in some parts, and a great many of them faded entirely in the course of a short time. Another

thing happens from the close proximity of the colors—say when ruled on as fine as those on this picture—there is set up a kind of decomposition which I do not understand. But the colors seem to mix with each other in time. This is independent, or apparently so, of the action of light. Where one of these pictures or screens or plates are subjected to treatment in an alkaline bath, it requires a different set of colors from those placed in an acid bath. It was an exceedingly difficult and tiresome work to obtain these colors.

The ruling machine upon which the lines for these screens was ruled is an exceedingly fine and delicate piece of work. These lines are ruled or rolled or printed in bands about one-three-hundredth of an inch in width. I can see upon the machine a separation of less than one-thousandth of an inch, if it should occur, and while the machine is in motion working I can shift the line one-thousandth of an inch. It lays the color on very evenly. It is disturbed by a grain of dust getting into the machine in some parts. I have been eighteen months, at least, working with it, and about the 1st of January, 1894, I got an assistant who has been working that machine and improving it in regard to its accuracy, etc., to the present time. I think it was the most difficult machine I ever constructed, and I have made a great many machines. It does not use a ruled pen.

I want to introduce another class of pictures. I have here a half-tone plate, made by the use of a negative taken through one of my line screens. It was made by the use of a cross-line Levy screen, and is pretty coarse, the Levy screen being one hundred lines to the inch. I have here a print from that, taken from that half-tone plate in the zinc. This is the first use I have made of a cross-line Levy screen. Those I have used before have

been what are called "single-line" screens. I have no print in colors of this, but I have a sheet of the paper painted with black, mounted on glass, over which is placed a screen with the three colors. The glass not being flat, the screen and paper picture are not pressed quite closely together. This work is meant to represent work done on a printing press into the half-tone plate, as described in my specification.

I have shown three sets of pictures made by different processes and manipulations, in all of which the line screen ruled with three separate and alternating colors, and lying side by side, were used in the beginning of the process.

I have said that when I left my place at 187 Broadway, New York, about the 1st of April, 1887, I left at that office two dry-goods boxes and two trunks containing apparatus and materials and stuff collected before that time. I will say here that I never saw those things again. They were removed by another party for safe keeping, and they were kept so safely that I never obtained them again, although I have often tried. I went to New York City last year, and while there I tried to find them, but without success.

Q. 8. You say that in the spring of 1881 you made some pictures by the use of lines, as well as in other ways. What were these lines placed or arranged on to enable you to make pictures, and what colors were used in making them? A. These pictures were made upon dry plates. The colors were such as I had bought in Chicago or New York, and were aniline colors.

Q. 9. In the making of these pictures, was a screen or plate employed? A. The plate itself, with the colors printed on it, constituted the plate or screen.

Q. 10. You say that this photography was never a

business with you. Please explain what you mean by that. A. I had a regular business of some kind up to three years ago, which required my attention at times—the manufacture of furniture and afterwards as electrician and general adviser to several telephone companies and one electric light company, upon which I depended for a living. This working in photography was a kind of recreation or hobby, carried on in spare hours. I hoped ultimately to make some money out of it.

Q. 11. To what extent have you made it your occupation or business within the last two or three years? A. Within the last two or three years it has been an important occupation with me. I must necessarily take care of my property and other interests extending years back. I have given it all the time and attention that my health would permit.

Q. 12. How does this statement above apply to the time since you went out of business in the summer of 1891? A. It is correct.

Q. 13. What do you mean by saying that you had never applied this process, to your recollection, to the commercial printing press? To what time does your statement have reference? A. Before the 16th of May, 1892, or about that time.

Q. 14. You say that you began experimenting with a ruling machine containing a roller with a sharp edge. When did you begin trying a ruling machine of that kind? A. It was in the winter of 1893-4, several months after I had bought the ruling machine of Fuchs & Lang.

Q. 15. Please state when or how early you made a screen or plate for photographic purposes having on its surface colored particles arranged according to regularly

recurring patterns, as dots, lines, figures? A. That was some time in the spring of 1881.

Q. 16. Please state when or how early you made a screen or plate for photographic purposes provided with different colored substances arranged according to regular recurring patterns, as dots, lines, figures, of such colors and proportions as to cause each to absorb such colors as are transmitted by each and all the others. A. That was some time in the spring of 1881.

Q. 17. Please state when or how early you made in photography the subdivision of the image by means of a screen on which are parallel lines ruled in several colors and in close juxtaposition, thereby producing compound colored effects? A. Some time in the spring of 1881.

Q. 18. How often since the spring of 1881, and say the first day of January, 1893, have you made screens or plates and done the things specified in the last three questions? A. I could not directly answer that question; but I have used them, when I have worked at this work, and worked with a camera or otherwise, for the actual taking of pictures, continually between the spring of 1881 and January, 1893. Working in this line has required a great deal of work, upon which the screens or plates naturally depended, and a large portion of my time has been taken up with the details of preparing colors, testing plates, papers, baths, and all other affairs which would naturally connect themselves with processes of this kind.

Q. 19. You may state whether the working out of a process of this kind is one that involved any special difficulties or lapse of time. If so, briefly enumerate them. A. I will say that to accomplish a commercial article that would satisfy practical men has been one of the most difficult things I ever undertook. The making of a crude

plate or screen; the taking of a negative and transparency and placing the screen behind the transparency, is possibly the simplest way of arriving at a picture. The colors are placed upon the screen, and it is not necessary to enter them in a bath in any way; it is not necessary that they should be permanent; it is not necessary that they should be spectroscopically, absolutely perfect; but to make these plates with accurate lines to obtain colors that would not fade out in a short time, more or less; to select colors that would pass through these baths of different kinds; to select colors spectroscopically correct and to even manufacture them; to apply this work to half-tone printing processes, has been a long and tedious labor. A man can naturally not work continuously upon such a subject. He must have ideas and thoughts and sometimes wait for them. I have arrived at times at obstacles which seemed almost insurmountable. The state of my health has been a great obstacle, that has made this work all the more difficult.

Q. 20. How far has it been necessary for you to go into the constituents of colors and study their characteristics and enter upon the special preparation of colors to secure the results in the employment of this process of making colored pictures at which you aimed? A. It has been necessary for me to obtain these colors; to find their names from those from whom I purchased them; to buy books treating upon the subject, of which I have a great many, and by actual experiment to make such combinations or changes in them as would fit them to my purpose. As I said before, I have experimented with a great number of colors. I have consulted chemists in this country, and, through others, chemists in the old country. As I understand, a year ago or more, possibly, I do not remember the exact time, a meeting of their

chemists, possibly twenty-five, as I understand, in number, was called by the Badische Anilin & Soda Fabrik, Ludwigshafen a/ Rhine, Germany, 98 Liberty street, New York, for the purpose of consultation upon these colors for my work. Their agent told me that they were going to keep it under consideration.

Recess until after lunch.

Aniline inks differ in their fluidity. Some are soluble in water, others in alcohol, glycerine, ether, turpentine, methyl-nitrate. They are often adulterated, or rather tempered, with foreign substances to lower them to a standard. They are not chemically compatible, in some cases, and will not mix without mutual destruction. Many contain gums. Names of these colors found in the trade are arbitrary or trade names, and two or more dyes may be sold under the same name or number. Their application to special machines for rolling them upon screens or plates require special study.

Q. 21. About what proportion of your time from 1881 to, say, January 1st, 1893, has been lost from your business on account of sickness? A. A large proportion. I have spent a good part of winters and summers in the country. I do not think there was a year in that time when I was not obliged to take a vacation at irregular times, for the purpose of keeping up at all. I should think one-half of my time has been lost on account of sickness.

Q. 22. You have referred to two patents issued to you March 22, 1892, Nos. 471,186 and 471,187. You may state how far the invention involved in this interference and the invention described and claimed in these patents sustain the relation of genus and species to each other, if you have any views on the question. A. I will

answer this question as I understand it. The patents of March 22, 1892, more especially refer to a picture in which the screens or plates used in the production of the pictures are made by placing small irregular spots of different colors, described in one place as red, yellow and green, or other colors, through which the light is sifted in its way from the object to be photographed to the sensitive material. Two particular processes are laid out for developing these pictures after the exposure has taken place. Others are referred to, as where the film is transferred to the screen upon which the colors are laid in small particles side by side. This method of transference of the film is common, it being employed in ordinary work where the films are afterwards removed and used as negatives; in another place it speaks of the formation of the negative or positive by well-known developing processes, and goes on to say that the colored is formed by the reflection of light through the colored particles or by the transmission of light through them. The foundation of these patents and of the application now in interference is substantially the same. The difference between the screens or plates described is that the colors in one case are placed on irregularly and in the other in regular alternating patterns, such as lines, dots, figures. The application in interference refers to special printing processes in which the screens are used to begin the work with. I understand this application in interference to be for specific things, and that the claims in the patents of March 22, 1892, cover these screens generically; at least Mr. Banning and myself used all our skill to make them do so.

BY MR. BANNING: Counsel for McDonough offers in evidence exhibits as follows:

McDonough Exhibit Ruling Plate, May, 1892.

McDonough Exhibit Ruling Plate, December, 1893.

McDonough Exhibit Electrotpe of Ruling Plate, December, 1893.

McDonough Exhibit Ruling Machine, September, 1893.

McDonough Exhibit Ruling Device, Winter 1893-4.

McDonough Exhibit Reproduction May, 1892, Screens.

McDonough Exhibit Screen Made on Roller Ruling Machine.

McDonough Exhibit Half-Tone Plate.

McDonough Exhibit Black Print of Half-Tone Plate.

McDonough Exhibit Painted with Black Mounted on Glass.

McDonough Exhibit Illustrative Transparency Park Scene.

McDonough Exhibit Illustrative Transparency Gate Scene.

McDonough Exhibit Illustrative Copy of Chromo.

McDonough Exhibit Delano Printing Press Form.

McDonough Exhibit Rood's Text Book on Color.

McDonough Exhibit Chevreul on Color.

McDonough Exhibit Draft of Specification, March, 1891.

McDonough Exhibit Cross Letter, April, 1892.

McDonough Exhibit Van Nostrand Bill, June, 1884.

McDonough Exhibit Panorama Printing Co. Bill, May, 1892.

McDonough Exhibit Fuchs & Lang Bill, September, 1893.

McDonough Exhibit Panorama Printing Co. Bill, December, 1893.

McDonough Exhibit Delano Bill for Press Form, May, 1894.

McDonough Exhibit Letters to the Heliotype Printing Co., February 19 and March 3, 1894.

McDonough Exhibit Letter from Heliotype Printing Co., February 21, 1894.

McDonough Exhibit Diaries for February, March and May, 1887, April, 1888, March, 1891, and April, 1892.

BY MR. BANNING: Counsel for McDonough states that with the consent of counsel for Joly he will have the copies of the letters to the Heliotype Printing Company cut out of the copying book, which appears to be a current book and in use, but will produce the book itself at the hearing.

Q. 23. When were the entries in the diaries offered in evidence above made? A. The entries were made, I believe, in every case, commencing on the day at hand. Some times they would fill the balance of such a page and be continued on the next page, when the page was not large enough to hold it.

Q. 24. How are these entries now with reference to their language or statements, as compared with such language or statements at the time the entries were made? A. They are the same now as when they were made. I know of no alterations made in them.

Q. 25. Have they always been in your possession or under your control from the time the entries were made until now? A. I know of no time that they have been out of my possession.

Q. 26. In whose handwriting are the entries? A. All of these entries are in my handwriting.

Q. 27. Are they original entries? A. They are.

Q. 28. Do you have the originals of the letters written to Professor Cross and the Heliotype Printing Company? A. No; I have not.

Q. 29. What are the copies which you have produced? A. The copy of the Cross letter is one made at the same

time on the typewriting machine as the one mailed to Professor Cross. The letters to the Heliotype Printing Company are letter-press copies in a copy-book taken from the letters mailed to them.

Q. 30. Do you mean that the copy of the Cross letter was made by the same impression as the one sent to him?
A. Yes; that is what I mean.

Q. 31. In whose handwriting is the draft of specification, March, 1891? A. It is in my handwriting.

Q. 32. How is it now as compared with what it was in words and language at the time you made it? A. It is the same as when I made it and presented it to Mr. T. A. Banning as a draft for the specification in this matter before us now.

BY MR. BANNING: Counsel for McDonough gives notice to counsel for Joly that he will on the argument refer to the patents to Mr. McDonough Nos. 471,186 and 471,187, together with the file-wrapper and contents of such patents.

Q. 33. You have referred to two articles in the Scientific American of July 2 and July 9, of 1881, which you have produced. Where did you get these articles?
A. I cut them out of numbers of that publication.

Q. 34. When? A. I suppose out of the current numbers, about the same time. I had them in a scrap-book at one time, and I believe tore them out years ago and filed them in a letter-book with my letters. They have been in my possession ever since.

Q. 35. Why did you cut them out and keep them?
A. They were articles purporting to give the state at that time of photography in natural colors, and as I was working at that time upon this problem, they were very interesting to me.

BY MR. BANNING: Counsel for McDonough offers the extracts of the Scientific American in evidence as McDonough Exhibits Scientific American, 1881.

Q. 36. When did you buy the two particular books, "Rood's Text Book on Color" and "Chevreul on Color," offered in evidence above? A. February 16th, 1884. They have been in my possession ever since. They belong to me.

Q. 37. From what were the pictures offered in evidence above, "McDonough Exhibit Illustrative Transparency Park Scene," "McDonough Exhibit Illustrative Transparency Gate Scene," taken? A. I was told they were taken from nature. I was not present when the negatives were taken. I believe they were; they have every appearance of having been. Mr. E. T. Flora, my assistant, went to Madison, Indiana, with instructions from me to take some pictures of autumn foliage with my screens and apparatus, and returned with the negatives to these pictures.

Q. 38. Did you ever have a patent issued in England for the substance of the two United States patents Nos. 471,186, 471,187, of March 22, 1892? A. Yes, sir. Such a patent as that was issued to me bearing the same date as the United States patent, March 22, 1892, in England.

BY MR. BANNING: Counsel for McDonough gives notice on the record that he expects to call George J. Klein, whose name in the notice is given as Charles J. Klein; a party named Otto Scuder, of 487 Lincoln street, Chicago, and Thomas A. Banning, of 225 Dearborn street, Chicago.

By agreement of counsel the further taking of tes-

timony is adjourned until Friday, December 13th, 1895, at 10 o'clock A. M.

Friday, December 13th, 1895. Ten o'clock A. M.
Met pursuant to adjournment. Present as before.

Q. 39. I notice a number of headings of propositions preceding the various quotations from Rood's Text-Book on Color, appended to the letter of Prof. Cross, as, for instance, "Colors of Mixed Light Produced by Lines or Dots." These headings or propositions are followed by reference to the page of the book and quotations from it. Why were these headings inserted, and who made them?
A. These headings were made by me as the subject to which the quotations referred.

Q. 40. Do you mean that they were propositions which you wished to establish by the quotations? A. Yes; and the object of putting them at the head of the quotations was to draw attention to the matter, so that it would attract the eye.

Q. 41. When was this identical exhibit marked "McDonough Exhibit Ruling Plate, May, 1892," made?
A. This identical ruling plate was made prior to the 16th of May, 1892.

Q. 42. When was this identical exhibit marked "McDonough Exhibit Ruling Plate, December, 1893," made? A. It was made prior to December 23rd, 1893.

Q. 43. When was this identical exhibit marked "McDonough Exhibit Electrotpe of Ruling Plate, December, 1893," made? A. It was made prior to December 23rd, 1893.

Q. 44. To what use or purpose were these three exhibits mentioned in the last three questions above applicable, or to which you could apply them, if any, aside from your color photograph work? A. I know of no

other use to which these plates could be put, at least by myself. Somebody might have thrown them at a dog.

Q. 45. Please state in what spirit the last sentence of your answer was made. A. It was addressed particularly to Mr. T. A. Banning, in a jocular sense.

Q. 46. Please state to what purpose alone you applied these plates. A. I never used them for any other purpose, except in the printing of these lines, for making these screens, and the paper accompanying them.

Cross-Examination by Mr. Freeman.

By consent of counsel, objections to the questions and answers were waived until the closing of the witness' direct testimony; and counsel for Joly has refrained from cumbering the record with objections. He does not propose at this time to make any extended objections, but simply states that he does not waive any rights to objections which are apparent on the face of the testimony, as to the form of the questions, as being leading and suggestive, and to the various statements in the answers which are in any way at variance from and inharmonious with the preliminary statement. Subject to this statement, counsel for Joly cross-examines as follows:

X Q. 47. In answer to question 1, you state that you have been an electrical engineer, but am now at "work on my own inventions." You are somewhat noted as an inventor, are you not, and have made a number of inventions, and will you please state about how many you have made? A. I have made a large number of inventions. I do not know how many. I think I am noted.

X Q. 48. What do you mean by "large number" in your answer? I do not expect an exact number, but

some number by which we can judge of what you mean by the phrase. A. Perhaps a hundred.

X Q. 49. What is the general nature of these inventions—that is, to what general arts do these inventions, or a majority of them, perhaps, apply? A. A large number of them were electrical apparatus; a number of them pertained to improvements in furniture, which I used in my business; a number of them to photographs in colors.

X Q. 50. Does this include all the arts in which you have made inventions? A. No. I have worked on flying machines; on making diamonds; in compounding colors; in street-car work, and some others, possibly.

X Q. 51. Among your inventions for electrical apparatus, what were the particular lines or branches of that class of inventions in which you worked? A. Telephony, telegraphy, electric lighting, motors, philosophical instruments in connection with these separate classes, storage batteries, and possibly other branches.

X Q. 52. Among these hundred or so inventions which you have made, for about how many of them have you applied for patents in the United States? A. Perhaps twenty; I do not know.

X Q. 53. Of these twenty or so applications for patents, how many have resulted in grants of patents to you for your inventions? In answering this question you may refresh your memory in any proper way you may desire. A. I cannot tell exactly, as I have no tabulated statement, and of a number of the patents I have no copies. I should judge from twelve to fifteen; may be more.

X Q. 54. Do you remember about when you filed your first application for a U. S. patent? A. I think my first patent was issued in December, 1866. I don't remember the date of filing.

X Q. 55. Of the fifteen or so patents you have received, about how many were granted prior to August, 1881, and how many since? A. I had three or four telephone patents granted to me about August, 1881. Before that date there were two, possibly three. The balance were granted and issued since.

X Q. 56. Have any of your applications or patents been involved in any litigation or legal contests, either in the Patent Office or in the United States Courts, and if so, please give a brief and general statement in regard to such contests? A. I was one of the parties to the telephone interference case, in which were involved Bell, Edison, Grey, Holcombe, Dolbear, etc. The contest involved the priority of invention of speaking telephones. A decision was rendered in my favor by the Primary Examiner of Interferences on the telephone receiver now in use. This was afterwards reversed.

X Q. 57. Over what period of time did that contest relating to the telephone receiver now in use extend? A. The interference was declared, as near as I can tell by reference, March 26, 1878; actual work in that case was not commenced until February 26, 1881, as I see by reference to the testimony, when Mr. Alexander Graham Bell was put upon the stand. I was present March 10th. I will add here, by reference to the book of testimony, I began my depositions in this case January 30th, 1881. The case was carried on by the parties having possession of my application for a number of years. It seems to me that their last action was in 1886 or 1887. These applications passed out of my possession by assignment, I think, some time in 1881.

X Q. 58. You were personally present and participated in many of the proceedings of this case, such as the

taking of testimony, cross-examination of the witnesses, arguments, etc., were you not? A. Yes.

Counsel for Joly here gives notice that he may hereafter, either in the taking of this testimony or the hearing of this case, refer to the records of the Patent Office in connection with this telephone interference.

X Q. 59. You say you have been an electrical engineer; when and under what circumstances did you acquire that title? A. I gave it to myself for want of a better title. I was a member at one time of the New York Society of Electrical Engineers, and have been in charge of an electric light manufacturing company as electrician, etc., for some time. I never had a card printed, and do not know that I ever had that on my door; still I needed sometimes to tell what my business was, as I was acting in that capacity.

X Q. 60. In answer to question 4 you state that you conceived the idea of the first count of this interference some time during the year 1878, or as early as January 1st, 1879; will you please explain in detail the circumstances connected with this conception, stating more particularly, if you please, how you came to conceive this particular idea and in just what way, form or embodiment your ideas took shape at that time? A. I had studied physics and natural philosophy in my school days. One of the ordinary experiments was to revolve a disk rapidly to show the mixtures of the primary colors which were painted upon this disk. I have always read with interest and studied the science of physics. I was acquainted at this time with the fact that lines or dots ruled in these primary colors upon paper and removed at a sufficient distance from the eye would produce the same

compound color effects as these revolving disks. I had read the different color theories of Young and Newton, and knew the difference between them. At this time, as I have said before, I was working on a color process in which three different negatives were made by the use of glass screens. A good deal of this work was done in a private room in the fourth story of my factory building, at 290 South Canal Street, Chicago. These screens were used for the purpose of suppressing certain colors and allowing others to act. I obtained three or more negatives, using them to form gelatine printing blocks, with which I printed upon paper, superposing them. These three printed superpositions formed a picture. This was not my own invention, and I believe was commonly known in public at the time. From my knowledge of the subject and physics the conception came to me of doing away with these three plates and forming a compound color plate to use in place of the three plain glass screens. I made some experiments with these three separate negatives and screens outside of my place about that time in the photograph gallery of George J. Klein. I do not remember of having worked with one of these compound screens at all during the year 1878.

X Q. 61. In your answer to question 7 you state to the effect that you began working again on colored photography and towards the spring of 1881 you made some of these pictures by the use of lines, as well as in other ways. Will you please describe in detail just how you made these pictures at this time? A. Having this object in view, I bought some aniline dyes. The first work I did, that I remember, was to dissolve them and scratch them with a common pen upon paper, trying to form these lines. I have used this pen method a great many times to save trouble since that time. Work done in this

way with a ruler to guide the pen is necessarily coarse and irregular. Following that came the idea of an engraved line plate, of which I obtained one, or had one made here in the city of Chicago. I could not use that immediately, I found, because I could not print from it to any extent, and after some thought and experiments I arrived at a way of printing upon glass or paper; I took gelatine, which I dissolved in water; I took these aniline colors dissolved in glycerine and poured them upon the surface of my engraved block, about an eighth or sixteenth of an inch in thickness, and over this, before the galatine had set, I placed a piece, at one time, of cardboard. When the gelatine had cooled off it was attached to the pasteboard. This arrangement was, if I remember, four or five inches square. I meant to say that the dissolved dyes were poured into the gelatine, forming a colored mass. I made several of these from the same line block. This gelatine sticking to the cardboard, when removed from the line block, had taken the exact figure of the ruled lines on the engraved block. When this was placed upon a piece of white paper or a gelatine surface it communicated its color to the paper much after the manner of the ordinary hektograph work. I printed with these blocks sensitized albumen paper and dry plates, as they are called, sometimes in three parallel lines, to fill up the surface, and sometimes in two sets of parallel lines and crossed them with a third. The colors I used were, one amongst others that I tried, what is called commonly an "insoluble blue," because it is not soluble in water to any extent; another was, I believe, methylosin; another was a green admixture, of which I do not remember the name, and a yellow that I do not remember, that I used for mixing to grade the other colors. These

were all soluble in glycerine and alcohol. This device I have used very often since. It is simple. The registering of these lines is a very difficult matter, and I was led, to obtain results, to the cross lining mentioned before, and to the printing of them directly upon the sensitive dry plate. This plate was used directly in the camera, and afterwards developed, giving a kind of picture which, after some other manipulations, was turned into a positive. Sometimes I blacked up the back of this picture; sometimes laid it on a piece of black paper. This was necessarily a crude picture, as developing a picture of this kind, with these colors, made more or less of a change in the colors; but it was a picture. I used at first a printing process in which I placed one of these plates in an ordinary photographic printing frame, under a piece of glass of the same size, upon which were drawn little square patches of the glycerine and inks used in the manufacture of the screen or plate. I used as a sensitizing material for the dry plate at that time, I think, eosin. After I had moved to New York City, which was sometime between April or May, 1881, and had fitted up my place, I made more pictures by this same device and method, and showed one of them, and may be more, to George J. Klein. I never made many that were worth showing, as so many were spoiled in course of making. I cannot tell how many even decent pictures I had. Mr. Klein, as I have said, came with me about the first of August, 1881, and remained about four weeks.

Recess for lunch.

I printed these lines on a glass plate covered with clear transparent gelatine, and upon paper upon which was flowed a solution of gelatine, giving it a smooth surface. I did that before printing them upon sensitized plates.

X Q. 62. Won't you please specify the characteristics of the engraved line plate which you say you obtained at this time? A. It was a metal plate, something similar to this marked "McDonough Exhibit Ruling Plate, December, 1893," and mounted somewhat like this, on a piece of board. It was about five inches square, I should judge. I think the lines were somewhat coarser than this. I do not remember the exact number to the inch.

X Q. 63. Do you remember what the pictures represented which you say you showed to Mr. Klein? A. I do not. I had a picture of a chromo containing some fruits; another one of a man with a guitar in his hand. I remember of having a Japanese fan, and think a picture of a jar with some flowers in it that I had used, besides the glass with the flat patches of color on it. It seems to me that I had some other picture. I don't remember which I had or showed to Mr. Klein at that time.

X Q. 64. Did these pictures represent the colors of the originals? A. They were approximate colors of the originals.

X Q. 65. Won't you please describe in detail just how you produced one of those pictures at that time? A. I have described one picture that was made from flat patches of color on a glass plate. I have also described the methods by which they were taken. I will repeat that.

I took a dry plate—I think I used at that time what was known at that time as "quarter" plates, three and one-quarter inches by four and one-quarter inches, and placed this plate in a bath composed of water and a small quantity of eosin. This plate was then dried. I wish to say here that these manipulations necessarily take place in a dark room, lighted only with red light. When this plate

was dry I printed these lines upon it by laying upon it the lined gelatine-colored contrivance that I have described before, say a blue for one set of lines, and next to it a red set of lines. I had a little wooden frame made of a flat piece of board, upon which was fastened a straight piece of wood for a guide. In case of a cross-line plate I printed at right angles with yellow. I had a plate then sensitized and printed upon with these lines. I placed this in a photographic printing frame next to and over the glass with the colors upon it, and fastened them down in close contact. I placed upon the open face of the photographic frame, so that the light would necessarily pass through it before reaching the glass plates before described, a piece of ruby flash glass. This glass was for the purpose of preventing the too rapid action of the higher refrangible rays of light. I then exposed this package to the light, and the light rays from the window penetrated the piece of ruby glass, the plate containing the flat patches of color, passed through the colored lines upon the surface of the sensitized dry plate, causing a latent image upon the sensitized plate. This plate I took out of the frame and placed it in a bath for development. It was afterwards placed in another bath, for the purpose of cutting out the silver not acted upon by the light or developer. This plate was washed in running water. This picture was a kind of a negative, and was afterwards immersed in a bath of chloride of mercury. This chloride of mercury formed a kind of a lake with the aniline colors, or what was left of them by this time, and turned the silver in the plate from black to white, thus forming what is called a "positive picture." The plate was washed out in water and dried, and to view the picture it was laid upon a piece of black paper or held towards some dark object or part of the room. These pictures

were semi-transparent. I will say that about that time I made a printing plate by painting a butterfly in these aniline colors upon a piece of glass. Around that butterfly I opaqued the glass and varnished it, and flowed the other side with a solution of gelatine or varnish and some red dye, and this I used the same as the other.

The taking of a picture in a camera was very much the same process, except that the fan, for instance, was tacked to the wall; the line plate was placed in the camera plate holder; a piece of red glass placed either in the camera or before the lens, the light from the object passing through the lens and the piece of ruby glass before it reached the sensitive plate. I had a little box which I placed on the lens of the camera, in which I could put different pieces of colored glass of different colors.

X Q. 66. In your answer to question 7, on page 5 of the typewritten record, you quoted several paragraphs from Rood's "Student's Text Book of Color;" what was your object in interpolating those quotations into your answer at that place? A. To introduce that book into this record, and those quotations, and to show that I had that book in my possession in 1884, and as a part of the introduction to the letters of Prof. Cross and others.

X Q. 67. In your opinion, what bearing have these particular quotations upon the subject matter of question 7? A. These quotations were very necessary, being taken from a book in use from 1881 at least, showing the state of knowledge upon the subject of the equivalency of lines and dots in alternate colors, approximately spectrum colors and others, for the production of these compound color sensations. One of these quotations says that this method of mixing light produced the same effect as that of revolving disks; another heading referred to the action of these revolving disks; another quotation shows author-

ity and the labor of different persons in fixing, as exactly as possible, the place of what are called fundamental colors in the spectrum; another referred to the beauty and brilliancy of mixing these colors in this way by closely ruled lines or closely placed dots. An explanation of these things is invaluable, as laying out the principles and foundation of this invention. It placed it clearly, as I thought, before the minds of those who read, or would read the Cross letter, and for that reason I quoted them there. They were necessary in the continuity of my narrative.

X Q. 68. Please state when you first heard that Dr. Joly, the other party to this interference, was making claim to the invention involved in this interference? A. Mr. Gayton A. Douglass wrote me a note a day or two before the 15th of December, 1894, saying that he had something he wanted to show me. Mr. Gayton A. Douglass is the gentleman to whom I gave a copy of the so-called Cross letter in April, 1892. I went there to his office at 111 State street, and he showed me a number of the American Journal of Photography for December, 1894. It contained an article, on page 556, headed "A Process of Photographing in Colors." I had Mr. Douglass write his name, and the date, and his business address on the same page. It was so close a copy of my American patents in places that we sat there and compared in mind and by conversation the two, the subject-matter of my 1892 patents, as far as the dusted or dotted screens are concerned. I wish to say that that is the first I ever heard of Prof. Joly's claiming this invention, or of Mr. Joly as a man.

X Q. 69. What other publications have you seen containing reference to the invention, or the claim to the invention, on behalf of Dr. Joly, of the subject-matter of

this interference? A. Here is a publication in Anthony's Photographic Bulletin, dated March 1, 1895, entitled "Photographs in Natural Colors, McDonotype Process." Near the end of this article is the following paragraph:

"We do not expect to be able to give further information on this matter until May; we would, however, refer our readers to the parallel column which appears in another part of this issue of the Bulletin, where comparison is made between a published account of Dr. Joly's researches in 1894 and those for which Mr. McDonough's patent was granted in 1892. The coincidence is remarkable, and the fact that Dr. Joly indorses the method should further strengthen belief in the capabilities of the process. We believe, however, that Dr. Joly will admit that his work has been somewhat anticipated by Mr. McDonough."

There is another article in this same number, page 98, headed "A Curious Coincidence." An article appeared in the Chicago Inter Ocean of February 6, 1895, entitled "Takes Photographs in Colors. James W. McDonough Process Which Reproduces Natural Tints." In the New York Weekly Tribune of April 17, 1895, under the head of "Science in Mechanics," the heading, "Illustration by Color Photography. Adapting the Single Screen Process to Book and Magazine Work." The Publishers' Weekly, of June 1, 1895, an article headed "Color Photography in Book Illustration;" an article dated June 23, 1895, The Chicago Chronicle, headed, "Photographs in Colors;" an article which I cut out of a paper dated "Chicago, June 20, 1895," of which the only part of the name of the paper left is "amp," the last three letters of the name of the paper; an article from the New York Tribune of July 3, 1895, entitled "Photography in Colors;" an article in the American Journal of Photography for March, 1895, headed "The Joly Colored Photography;"

an article in the St. Louis and Canadian Photographer, entitled "Polychromatic Photography, Making One Negative Answer for Three in Color Composites;" an article in the New York Herald of August 25, 1895, entitled "Color Photography."

I have had a half a dozen newspaper scraps mailed to me that have been cut from papers without headings, which I have received this summer from different parties. I do not know at present from what papers they were cut.

Some of these publications refer to my invention, and some to Prof. Joly's claims; some compare the two claims in the same article.

X Q. 70. Referring to the publication in Anthony's Photographic Bulletin of March, 1895, mentioned in your last answer, do you know who wrote the article entitled "Photographs in Natural Colors. McDonotype Process"? A. I believe they were written by Mr. Frederick J. Harrison, who is the editor of that paper. I never saw the article as it is written, nor a proof of it, nor a copy of it, until I received the book, which I have subscribed for for years.

X Q. 71. Do you know anything about the circumstances connected with the writing or publication thereof in any way? A. I do. I called upon E. & H. T. Anthony & Co. in February of 1895, as I had done for many years, and had in 1892, the year in which I sent them a substantial copy of the letter to Prof. Cross, and showed them samples of my pictures, and had a talk with Mr. Harrison and others there, and showed them the book referred to as the article from "The American Journal of Photography," calling their attention to the remarkable similarity between the claims in this article and my patents granted in 1892, March 22. Mr. Harrison asked me, as a personal favor, to allow him to print

an article on the subject of our conversation. I told him he might. He thanked me very kindly for the permission. I went to Florida immediately after this conversation, and did not see him for some time after that, and received a copy of this Photographic Bulletin in Florida. It interested me very much.

X Q. 72. When, if ever, did you first see what purported to be a copy of the specification of the British patent No. 14,161, to John Joly, for Improvements in or Relating to Photographing in Colors? A. I think the date is May the 10th, 1895.

X Q. 73. Did you ever see or hear of a copy of the British Journal of Photography, bearing date Friday, November 16, 1894, which purports to be the organ of all leading British and foreign photographic societies, published weekly in London? A. No, I never did. I never saw Prof. Joly's claims in any publication until I sent for and received a copy of the British patent. I never saw them or knew the subject of those claims until I sent purposely and got a copy from England.

X Q. 74. Did you ever see or hear of an article entitled "Photography in Colors," published in the British Journal of Photography, bearing date September 26, 1894? A. I never saw it, and don't remember of having heard of it. In fact, I can say I never saw or heard of the article shown to me here in the Journal of Photography of September, 1894. I do not remember now of having seen any reference to that article.

By agreement of counsel the further taking of testimony is adjourned until Saturday, December 14, 1895, at 10 o'clock A. M.

Saturday, December 14, 1895, 10 o'clock A. M.
Met pursuant to adjournment. Present as before.

Cross-examination continued.

X Q. 75. In answer to question 21 you say, among other things, in effect, that you should think one-half of your time has been lost on account of sickness. This was in answer to the question as to what proportion of your time from 1881 to 1893—January 1, 1893—had been lost from business on account of sickness. How was that lost half of the time between those dates distributed? A. I think it was pretty evenly distributed. Sometimes I would be away from work two or three months, sometimes six months. At other times I would have spells of sickness which would last me from a week to ten days. I spent the winter—a good part of the winter—of 1892 in Florida, and the fall in Colorado.

X Q. 76. You have made numerous quotations from your diaries tending to show the state of your health, and from this I judge that you are in the habit of making notes or memoranda in those diaries in regard to your health and physical condition. Will you please examine your diaries in some given year, as 1892, for instance, referred to in your former answer, and let us know just what you find therein in regard to this question? A. I cannot say that I was in the habit of making these specific entries in regard to the state of my health, but I made a great many references to it, and know from my diaries the date at which I left my work and the city on account of my health.

I find I left Chicago January 28, 1892, to go to Florida to spend the winter. I have been in Florida in the winter for the last four years on account of ill health en-

tirely. I went to Cuba that winter. I arrived from that visit in Florida in Chicago on the 13th of April. I find on the 14th of April an entry, "Snow and neuralgia. Stayed in the house." Neuralgia and sciatica and intense pains are part of the symptoms of my trouble. I started for Colorado the 12th of August, 1892. I went to Colorado because I was very unwell. I find on the 27th of August a note, "Dr. Robinson, oculist, to see about my eyes." I have great trouble with my eyes when I have one of my sick spells. I cannot look at reading matter at all.

I see an entry Monday, the 5th of September, "Sick with colic. Dr. Moore, No. 1 Cascade avenue." I wish to say in regard to these sick spells, they are produced by over-nervousness, and one of the first symptoms is a violent vomiting, which I have had continue for four days at times. I think this spell lasted three days, in which I was constantly attended by the doctor, and ate nothing whatever. I returned to Chicago the 9th of September. I left Colorado because I was too sick to stay there. I find on the 28th of September a memorandum, "Sick all day." I do not see any other specific reference to this after that in the year. I went to Florida again in the winter of 1892-3.

X Q. 77. Please make the same examination of your diaries for the year 1893. A. I wish to say that the diary for 1892, that is, the preceding year, was bound in monthly parts. Not being able readily to obtain a set of books similar to those, I began keeping a more abridged diary, bound in one volume. On the 8th of February I started for Florida. I find on March 16th the following entry: "Headache." If I remember, I had a very sick spell at that time. I arrived in Chicago the 6th of April, 1893. This diary is very abbreviated, and contains hardly

anything else but my private business affairs. I do not find any other reference to my sickness.

X Q. 78. While you were in Florida in 1892, and in Colorado, as you have stated in answer to cross-question 76, were you so ill that you were not able to attend to business in any way? A. At times I was, but not all the time.

Counsel for Joly here offers in evidence the balance of McDonough's diary for 1892, the one for April having already been offered in evidence, and the notary is requested to mark the same "McDonough Exhibit Balance of Diary, 1892."

Counsel for Joly offers in evidence the copy of "American Journal of Photography for December, 1894," referred to by Mr. McDonough in his answer to cross-question 8, and the notary is requested to mark the same "McDonough Exhibit American Journal of Photography for December, 1894."

X Q. 79. Please state generally your financial condition during the years 1892, 1893 and 1894. A. It was decently good.

X Q. 80. In your answer to question 7, on page 20 of the typewritten record, referring to the second division, known as patent No. 471,187, you state in effect that in preparing this application you made a sentence or explanation, which you quote, and which is as follows:

"I will merely add that the particles are dusted, spread or placed upon the plate in such proportions as to produce a white or transparent surface."

This quotation is from page 2, commencing line 24 of said patent, as I understand. In giving your testimony in regard to this matter, I notice you emphasized the word "placed" in the quotation above. Will you please state what was your object in adding this sentence or explana-

tion to the second division, and if you intended to add any significance to the word "placed" by emphasizing it?

A. This quotation,

"I will merely add that the particles are dusted, spread or placed upon the plate in such proportions as to produce a white or transparent surface,"

is the wording of Mr. T. A. Banning. When he had composed it he said he thought it would cover any way of putting these colors on the plate, in lines or otherwise. I think I did intend to add significance by using it.

X Q. 81. In your answer to question 7, on page 25 of the typewritten copy, and referring, as I understand, to the letter to Prof. Charles R. Cross, dated April 25th, 1892, and to the twelve or more letters, which I understand were substantially the same in effect, you state that you received five answers to these letters. Have you those answers, and will you produce them for inspection?

A. I think I have in my letter files. I have no objections to producing them.

The letters produced are offered in evidence, and the notary is requested to mark the same "McDonough Exhibit Answers to Cross Letter." For purposes of identification they are here recited:

Gayton A. Douglass, April 22, 1892.

G. Cramer, April 28, 1892.

M. A. Seed Dry Plate Co., May 5, 1892.

C. R. Thwing, April 21, 1892.

V. M. Wilcox, April 28, 1892.

Charles R. Cross, May 12, 1892.

I ought perhaps to add to my answer that upon examination I find that the Douglass letter and the Thwing letter above mentioned were received several days before the date of the Cross letter, and are therefore not strictly answers to it.

X Q. 82. I notice that the Douglass letter of April 22, 1892, inquires if you will give an evening to the photographic section of the Academy of Sciences, and tell them about your patented method of color photography. Did you accept that invitation? A. I went to Mr. Douglass personally and told him that I could not set any time when I could calculate upon my health being good enough to fill any such engagement.

X Q. 83. I notice in the letter of Prof. Thwing of April 21, 1892, reference is made to an article in the Scientific American of April 16th, giving an account of your invention. Did you have anything to do with the publication of that article, directly or indirectly? A. If I remember that article, it was a copy of one of my patents issued in 1892. I do not remember whether there were any comments upon it whatever. I knew nothing of it until I saw it in the paper.

X Q. 84. I notice that in one or more of the letters there is a request that you send the writers samples or specimens illustrating your work under your patents. Did you comply with any of these requests? A. I did not.

X Q. 85. Why? A. I did not have anything, as I remember it now, that I wanted to send as a sample of my work to critical judges.

Recess for lunch.

X Q. 86. You have spoken in your testimony of the Levy screen. Please state what the pronounced characteristics of that screen are, and, you may add, of the so-called Levy process you have referred to? A. The process to which the Levy screen is applied was invented by a German by the name of Meisenbach, of Germany. This process depends upon putting in the camera before the

sensitive plate a fine lined screen, the lines of which are opaque—sometimes a single line screen—that is, a single set of parallel lines, and sometimes lines crossed at right angles. The process depends upon a peculiarity in the action of light. Rays from the sun, in passing through a small aperture, cross one another at this aperture, and become wider as to their path. The screen in operation is placed at a small distance from the sensitive plate, and advantage is taken of this divergence of rays to obtain a picture in small, say, dots, the size of the dots depending upon the amount of actinic light reaching the sensitized plate in a certain time. The Levy screen is so named from a manufacturer of very nice screens. The lines on these screens are theoretically absolutely opaque.

X Q. 87. Are you familiar with the so-called Kurtz process of heliochromy, and if so, will you please give a brief explanation of its characteristics? A. I am acquainted generally with the characteristics and theory of the so-called Kurtz process. I may not know anything about their secret manipulation; or late variations in this process.

Three separate negatives are made of an object by sifting the light from the object through three separate plain or monochrome screens. The colors of these screens, as near as I can describe them, are the complementaries of red, yellow and blue—all compound colors, except the blue, which is the complementary of yellow, and is used in different shades, according to the fancy or needs of the operator. One is a mixture of blue and green, forming a bluish green; the other a kind of purple. From these three negatives, which are usually without any marking or marked characteristics, or, in other words, plain negatives, half-tone metal plates are made, and printed in red,

yellow and blue, upon printing paper, say. These colors are superposed. The superposition in certain parts forms the various mixtures of colors—for instance, a red placed over a blue will form a purple; a blue placed over a yellow makes a green. The superposition of the three colors forms all the black in the picture, unless at times a black is printed over them as a fourth “color.” In this process the old theory of color, sometimes known as “Newton’s theory,” is applied. The fundamental colors are assumed to be red, yellow and blue. A half-tone screen might be placed in the camera when taking the negative. I have never seen any practical work done this way.

The ordinary Kurtz picture is apparently made up of small colored dots. These are caused by the action of a half-toned screen—say a Levy screen—in some part of the manipulation. Each of the three half-toned plates is made up of these dots. The center of position of each dot is very regular, because the half-tone screen is very regular. I will say here that these regular lines, in any picture, are objectionable, to me, at least, and at present the effort of inventors is to suppress them. I am working myself in my processes to do away with the visible lines in my pictures. Mr. Kurtz himself told me he was working to that end, and showed me some very fine work in three-color work, or heliochromy, done under the direction of the Russian Government, in which the lines are entirely dispensed with, the particles being irregular on the three or more printing plates.

X Q. 88. I suppose you are also familiar with the so-called process of composite heliochromy of Ives, and if so, will you please favor us with a brief statement of the principal characteristics of this process? A. Mr. Ives’ process is one in which three separate negatives are made

by the employment of three separate monochrome screens placed before the sensitive plate in the camera. From these three negatives three separate positives are made, one for each color screen; each one of these positives is placed in a magic lantern, with a colored screen, each screen differing in color. The three images are projected upon a canvas overlapping each other, and exactly registered upon the canvas. The picture formed is necessarily a mixture of the colored lights falling upon the canvas and proceeding from the three magic lanterns. He has also an arrangement by which the three colored positives transmit colored light by means of the reflections from mirrors, so as to be re-composed upon the retina of the eye. In all cases he uses three or more exposures, makes three or more negatives, three or more positives, and must compose his pictures by means of mechanical devices.

X Q. 89. Have you seen or are you familiar with U. S. letters patent 432,530, granted July 22, 1890, to F. E. Ives, for Composite Heliochromy? A. I have never seen this patent before.

X Q. 90. When did you first become acquainted with the general principles or characteristics of the Ives process of heliochromy? A. A number of years ago; I do not remember exactly when.

X Q. 91. Do you think it was as early as 1890, the year of the Ives patent above referred to? A. I do not think it was as early as that, but it might have been soon after that.

X Q. 92. Do you remember where you first obtained your information in regard to this Ives process—whether from accounts of the same in numerous journals or publications or otherwise? A. I think it was from some publication. I do not remember what one.

X Q. 93. Do you know whether or not it was gener-

erally considered that the Ives process represented an important or valuable contribution to the art of heliochromy at the time? A. I considered it so. Mr. Ives entered into a controversy with other people who did not think so.

X Q. 94. Do you remember to have seen an account of any lecture of Mr. Ives on this subject, in which he set forth more or less of the state of the art of heliochromy, at that time, and discussed the subject more or less, and which lecture was published in one form another in many of the United States and foreign publications relating more or less to the general subject of photography? A. I remember reading an account of a lecture of Mr. Ives, I think, given in England. I don't remember the date of that lecture, or when I read it. I think I read of it or some lecture in the American newspapers or photographic journals. I had a small book given to me—I don't remember when—that was written and compiled by Mr. Ives. I think this book was for private circulation rather. This book was copyrighted in 1889 by F. E. Ives.

X Q. 95. Did you ever hear that the Ives invention in composite heliochromy had been spoken of or designated as being "the sensation of the last quarter century," or any words of similar import? A. I don't remember of having heard that.

X Q. 96. Will you please explain in detail, so that the court may fully and clearly understand the same, just how your exhibit in this case, marked "McDonough Exhibit Illustrative Transparency Park Scene," or the one marked in the same way with the words "Gate Scene" in place of "Park Scene," was made by you or under your direction? A. These pictures were both made under my general directions, although I was not present when the negatives were made. The negative was made

by my assistant, Mr. Flora, at Madison, Indiana, and represents in one case a scene on the edge of the woods, in which two men, I believe Mr. Flora's brothers, were lying on the grass. One of them had an American flag in his hand. Mr. Flora took with him a camera and a ruled lined screen. This screen was made under my direction and contained on its surface three sets of parallel lines in alternating colors, one red, one green, one blue.

Our usual way is to place this screen in the plate-holder of the camera, and place upon it an orthochromatic dry plate. This orthochromatic dry plate is placed with the film side of the plate in as close contact as possible by squeezing it upon the colored lines upon the three-colored compound screen. We try to have all of these plates as level as possible to insure perfect contact, so that the lines which are formed upon the negative will register as exactly as possible with those of the lined screen. The negative in this case was made, I believe, from an ordinary commercial Seed's dry plate, sensitized by cyanin and eosin. It was not perfectly flat, and the consequence is that the pictures are not in absolutely perfect register.

These plates having been placed in the camera-holder, an exposure was made on the object, so that the light from the object passed through the lens of the camera, through a plain colored screen, for the purpose of retarding the action of the more refrangible rays, through the multi-colored screen, and fell upon the sensitive material of the plate, upon which they form a latent image. This latent image was developed by putting it in a developing bath after it had been taken from the camera, thereby making a negative. A negative, in short words, is a picture in which the whites of an image are black, and the blacks transparent. This negative, in this case, was in lines corresponding in size and position to

those of the colored screens used in the camera. This negative may be said to be in plain black and white. From this negative a positive was taken by placing a plain dry plate in contact with the negative, in the usual way for printing positives. It was exposed to artificial light for a number of seconds, the light passing through the negative before reaching the sensitive plate, and impressing upon it a latent image which was developed as in the first case. This positive is supposed to be an exact *fac simile* of the negative, in the position of the lines and general picture, except that it is reversed, forming a picture in which the whites are white and the blacks black. When this positive is finished, it is a very pleasant picture to look at, when held up to the light.

This positive picture is in exact register, as to the lines formed upon its surface, with the screen through which the negative was taken, and is placed over and in contact with a similar screen, and the screen and positive pressed tightly together. The screen being moved in relation to the positive, so that the lines will register, that set of lines formed through the action of the green lines of the screen used in taking the negative over the green lines of the screen used in forming the transparency, the lines formed by the action of the lines formed by the red lines of the screen over the red lines of the screen, forming that transparency, etc. This colored screen was fastened at its edges to the positive picture, to secure it, and a piece of glass placed over the screen to protect the screen and form a secure package.

This particular method of forming transparencies is described in my letter of February 19, 1894, to The Heliotype Printing Company, of Boston, commencing with the words, "This is a kind of compound screen," and ending with the words:

“Any number of transparencies or prints may be made from the negative, as from any negative. Paper or sheets of gelatine or celluloid may be printed in quantities, exactly like the screen, except in lighter tints, if desired. The transparency is fitted over one of these sheets and the colors of the object show through. The other colors are either shaded down or covered entirely.”

The chief difference to be observed is that the screen is cross lined in colors, and this one made for illustration is in straight lines. Both are claimed in the application.

In giving descriptions of these processes for making transparencies like the exhibit, the description of the Ives process, of the Kurtz process, and the Levy screens, I have endeavored to be as brief as possible, and avoid technicalities.

By agreement of counsel the further taking of testimony is adjourned until Monday, December 16, 1895, at 10 o'clock A. M.

Monday, December 16th, 1895. Met pursuant to adjournment. Present as before.

Cross-examination continued.

(Answer continued.) I will say, in addition to my answer, and in regard to the two transparencies marked “McDonough Exhibits Illustrative Transparency Gate Scene” and “Park Scene,” that they were both taken from the same camera screen. That particular screen was split in two immediately after these pictures were taken, while taking another picture, as I have been informed by Mr. Flora. By “split in two” I mean that it is broken entirely in two down through the middle of the screen, making two pieces of it, which destroyed it through this accident, and the screens used in forming these transparencies are other ones. I will add that we

very often fit a positive upon the screen through which the negative was taken in the camera, thus using the same screen for taking and for viewing the transparency. But in these particular transparencies different screens were used. They are ruled in the same colors as the camera screen, and as near to match in register and width of each particular line as we could do it.

Counsel for Joly here offers in evidence a copy of Anthony's Photographic Bulletin of March, 1895, containing the articles referred to by the witness on "Photographs in Natural Colors—McDonough-type Process," and "A Curious Coincidence," and the notary is requested to mark the same "McDonough Exhibit Anthony's Bulletin, 1895."

Also a copy of the British Journal of Photography, dated November 16, 1894, containing copy of Joly's British patent, No. 14,161, of 1894, and the notary is requested to mark the exhibit "McDonough Exhibit British Journal of Photography, November, 1894."

Also an article from the Photographic Quarterly, Vol. 3, October, 1891, to July, 1892, containing a copy of Ives' Lecture referred to, and the notary is requested to mark the same "McDonough Exhibit Photographic Quarterly, Ives' Lecture."

X Q. 97. Have you in your possession, and can you produce, the camera screen used in taking these two pictures, which you say was broken in the middle? A. I have part of it, the greater part of it, and here produce it.

This screen is offered in evidence, and the notary is requested to mark the same "McDonough Exhibit Broken Camera Screen."

I might add that the camera screen just here introduced is varnished on the color side, giving it a slightly

general different shade from those in the transparencies. We often varnish the transparency screens as well. When they are varnished they can be handled better.

Re-Direct Examination by Mr. Banning.

R-D. Q. 98. Beginning, say, with the year 1892, and including that year and 1893 and 1894, how constantly were you at work on the invention now in interference?

A. I have worked on it at every opportunity, keeping it constantly in mind and doing all that I thought I could do, when I was well enough, and not occupied by needful affairs.

R-D. Q. 99. What was your object in making this "McDonough Exhibit Half-Tone Plate" and this "McDonough Exhibit Black Print from Half-Tone Plate"? A. It is to illustrate the process claimed in claim 9 of my application.

R-D. Q. 100. Do you mean that they are to illustrate the half-tone plate and half-tone print mentioned in that claim? A. Yes, they were made for the illustration of that particular claim.

R-D. Q. 101. How about this "McDonough Exhibit Printed in Black, Mounted on Glass"? A. It was made to illustrate the effect of printing the colors in lines, together with the print of plain black from the half-tone printing plate upon white paper, and is to illustrate the same claim, 9.

R-D. Q. 102. I notice that the first and second counts of the interference speak of a "screen or plate," while the third count speaks of a "screen." What is the difference, if any, between a plate and a screen? A. I will answer this by an illustration. If I take a piece of glass, say six inches square, that is colored red, it would ordinarily be called a plate of glass; if it were put in

the camera, so that the light from the object to be photographed must pass through it before reaching the sensitive plate, it would become a screen. In one of these photographic plates of which we have been speaking, these colors have been put directly upon the face of the glass or celluloid or gelatine or mica, as it may be. In one of them the colors have been placed upon the sensitive material. In all cases when they are placed in the camera so that the light must penetrate and pass through them before reaching the sensitive material, they act as screens.

Re-Cross Examination by Mr. Freeman.

R-C. Q. 103. What is your opinion of the relative value and importance of this invention in connection with the state of the art. A. I think it has come to stay. A photographer will be able to give you a picture of yourself or your wife in natural colors. Photographs of materials such as carpets, lamps, furniture, crockery, etc., may be made quickly and in approximately natural colors. It will be used for magazines and kindred illustrations. Copies may be made of oil paintings. I think it will take its place practically amongst the advanced arts of the world.

Re-Direct Examination by Mr. Banning.

R-D. Q. 104. State what your practice has been with reference to experimenting with an invention before applying for a patent on it. A. I only remember one case where I have applied for a patent where I have not made to myself a practical demonstration of the actual working of the invention. No matter when I conceive an invention, I have waited until I have reduced it reasonably to practice before making an application, except this

one case. That was not this case. I have not been in the habit of taking people very largely into my confidence, but have had communication with them when it became necessary for them to understand the subject they had in hand.

JAMES W. McDONOUGH.

THOMAS A. BANNING, a witness produced, sworn and examined on the part of McDonough, in answer to the following questions, deposed and testified as follows:

Q. 1. State your name, age, residence and occupation, and whether you are acquainted with James W. McDonough, one of the parties to this interference, and what, if anything, you know with reference to the invention in controversy. A. Thomas A. Banning; age, forty-four years; residence, Chicago, Illinois, and occupation, attorney-at-law. I have been engaged exclusively in the practice of patent law for upwards of fifteen years, and during that time have solicited a great many patents. I am acquainted with Mr. McDonough, and have been for five or six years.

About the 1st of March, 1891, Mr. McDonough came to me and desired me to prepare an application for a patent on color photography. The subject was new to me, and at my request he wrote out a statement to guide me in the preparation of the specification and claims. This statement is the one that has been quoted in the deposition of Mr. McDonough and offered in evidence as "McDonough Exhibit Draft of Specification, March, 1891." He brought this statement to me a few days before the preparation of the specification and application. I find by reference to the original copy or files that I have kept

of the case, that the application was sworn to March 10, 1891. The specification was filed March 14, 1891.

I used the statement prepared by Mr. McDonough to guide me in the preparation of the specification and claims, and then filed the statement among the papers in the case, where it remained until taken out for use in the testimony in this interference. The statement now is just as it was when it was handed to me by Mr. McDonough a few days prior to March 10, 1891. I notice three or four check marks in pencil on this statement, which I believe were placed there by me while I was dictating the specification.

In the statement there is a sentence saying that "These colors may be ruled in fine lines," and at the end an inquiry saying "What about a claim for lines?"

At the time I prepared the specification Mr. McDonough explained to me that the different colors with which the plate was to be provided might be applied by ruling them on in fine lines, as well as in other ways. I regarded that as a specific way of applying the colors, and told Mr. McDonough that according to the practice of the Office he would not be permitted to claim the invention generically and more than one specific way of carrying such generic invention into effect, and that if we described anything that we did not claim it would be considered, under numerous decisions, as a dedication of such matter to the public, so that he could not thereafter get a patent covering it. I advised him, therefore, to leave out any description of the application of the colors to the plate by ruling in fine lines.

In drawing the claims as they were filed in the Office, I prepared a claim as follows:

"3. A plate for photographic purposes, having upon its surface a layer of different colored particles

lying side by side, substantially as described.”

I regarded this claim as a broad one, but it was afterwards amended, so as to read as follows:

“3. A plate for photographic purposes, having upon its surface a layer of different colored particles lying side by side, and in such proportions as to produce a white or light colored transparent surface to which may be applied a sensitive compound, substantially as described.”

The Office objected to the claim as thus amended on the ground that claims 3 and 4 were for the same thing, and that the words “may be” in the third claim should be changed to “is.” An objection was also made that a new claim, 5, introduced could not be claimed in the pending application.

I replied to the action of the Office by insisting that claims 3 and 4 were not for the same thing, and objected to restricting the third claim to a requirement that a sensitive compound was to be added or applied, as I thought that the objection was not well taken. In my reply to the Office, I said:

“It is also suggested in the Office letter that the words ‘may be’ in the third claim should be changed to ‘is.’ Inasmuch as it is a fact, as described in the specification, that the sensitive compound may or may not be applied to the plate, we see no reason why applicant should be required to limit himself to its application. He describes two ways. The Examiner asks him to specifically limit himself to a statement of one way. Besides it is proper to state that a thing ‘may be’ done, when from the nature of the invention it is not necessarily and always required to be done in order to embody the invention. There is a very good reason why applicant should not be restricted to a positive ‘is,’ unless the positive statement be necessary to embody his invention in this case; for instance, parties would make the plates and sell them, claiming that they did not in-

fringe because they did not actually spread the sensitive compound on them, still they would have made the plates that that might be done. We must therefore request that this requirement be not insisted upon."

The next communication from the Office waived the objections that had been made to claims 3 and 4, but still insisted that claim 5 was "for a different species from that covered by the other claims," and refused to allow it with them.

Thereupon the fifth claim was withdrawn, with the view of filing a separate application, and on October 1, 1891, the application was allowed.

I then prepared another application, which I believe Mr. McDonough has referred to as the "second division," from which I understand that he treated the first application as one division from his original draft of specification, and the second application as a second division of it. This second application is sworn to, as appears from our office files, September 29, 1891, and was filed October 5, 1891, as Serial No. 407,787.

At the time I prepared this second application we again had a consultation in reference to whether we should in this second application embody a specific description of the application of the colors to the plate by fine ruled lines. I advised against it on the same grounds as before, but inserted on the first page of the application as it was filed in the Office, after describing the application of colors to the plate by dusting them with a mixture of colors, a sentence as follows:

"The particles, however, may, if preferred, be applied in other ways, so long as the same result is secured."

I also added a sentence to the specification at the end to broaden its meaning or signification, as follows:

“I will merely add that the particles are dusted, spread or placed upon the plate in such proportions as to produce a white or transparent surface.”

These sentences were inserted as the result of the consultation between Mr. McDonough and myself, in which we desired to make the application broad enough to cover any way of applying the colors to the plate, without inserting a specific description of lines, as I was afraid that such a description could not be covered in the application under preparation, and that it would jeopardize the possibility of his afterwards securing a patent specifically covering such method of applying the colors. I recollect of advising Mr. McDonough that the word “placed” in my opinion would be broad enough to cover any particular method by which the colors were applied to the plate.

The Office objected to the statement that I have quoted from page 1 on the ground that it was indefinite. I prepared a communication to the Office under date of January 6, 1892, in which I said:

“It is objected that the sentence beginning in line 18 of the first page is indefinite, and that it should be cancelled. This sentence merely states that other ways may be employed for providing the plate with colored particles. The invention is broader than the mere specific way of putting on the colored particles, and we intend the claims to cover the plates however provided with the particles. We do not deem it necessary, however, to retain the sentence objected to as being indefinite, to entitle the claims to such construction, and so we authorize the Office to erase the statement on the first page objected to.”

The erasure of the sentence from the first page, as above authorized, was done in pursuance of the policy I was following not to describe any specific species of the in-

vention which I could not claim in the pending application, so as not to militate against Mr. McDonough's chance of covering them by subsequent applications, which, at the times of preparing these applications, he informed me that he desired to make.

During the pendency of these applications, and subsequently, Mr. McDonough has talked with me about the application of the colors to the plates by ruling them or applying them to the plates in fine lines, so as to form a definite or regular pattern, but on the occasion of the preparation of his two applications the matter was made the subject of definite consideration and discussion, so that it became, and has remained, impressed upon my mind.

Cross-examination waived.

THOMAS A. BANNING.

THOMAS W. ROBERTS, JR., a witness produced, sworn and examined on the part of McDonough, in answer to questions by Mr. Banning, deposed and testified as follows:

Q. 1. State your name, age, residence and occupation. A. Thomas W. Roberts, Jr.; age, thirty-three years; residence, Chicago, Illinois; and occupation, printer.

Q. 2. Do you know Mr. James W. McDonough, here present? A. Yes, sir.

Q. 3. Look at this bill, marked "McDonough Exhibit Panorama Printing Bill, May, 1892," and state whether you ever saw it before. A. Yes, sir; I have seen that bill. I made it myself and did the work charged upon it.

Q. 4. Look at this bill, marked "Panorama Printing Company Bill, December, 1893," and state whether you

ever saw it before. A. Yes, sir; that is my bill; I made it myself, and also did the work charged on it.

Q. 5. This bill of May 16, 1892, referred to in the third question is for five hours' work. What was the work represented by that charge; what were you doing?

A. Press-work, from an engraved plate, printed in colors.

Q. 6. Look at this plate which I have shown you, marked "McDonough Exhibit Ruling Plate, May, 1892," and state whether you ever saw it before. A. This is the plate that the five hours' work was done upon. It has been marked some since, but I recognize the plate.

Q. 7. State what kind of work you did on this plate in May, 1892, and how the work was done. A. First I—the first work upon the plate was color printing on enamelled cardboard. I don't recollect which color I run first; I was printing three colors, and endeavoring to lay the lines alongside. The colors were red, yellow and blue. After printing on the cardboard I printed some on celluloid. The whole of the work upon that plate was five dollars.

Q. 8. Look at this electrotype marked "McDonough Exhibit Electrotpe of Ruling Plate, December, 1893," and state whether you ever saw that before. A. This is the plate the fifteen hours in 1893 is charged upon.

Q. 9. Please state what work you did on this plate in December, 1893, and explain how you did the work. A. The work was similar to the first. It was printed on paper first, then on gelatine, and celluloid, I believe.

Q. 10. After you had printed one color from these two plates you have identified, what did you do next? A. I washed up the press, put on another color, and printed it, trying to lay the lines alongside of the first without blending.

Q. 11. And as to the third color, what did you do ?

A. The third color was the same process, with the exception that occasionally we crossed the lines, instead of laying them alongside.

Q. 12 Was any interval of time allowed to elapse between the putting on of one color and the putting on of the next ? A. Usually about a day between; sometimes not quite so long.

Q. 13. What was the object of that ? A. To allow the colors to dry.

Q. 14. Do you remember whether Mr. McDonough said anything to you about what purpose he had in having you print the colors, as you have explained ? A. My recollection is that he said it was for photography for color printing. I didn't ask him much about it, but that is the understanding I had, during the first work.

Q. 15. What kind of inks did you use for printing from these two plates, if you remember ? A. First we used the regular printing inks; they did not give satisfaction; then we tried an ink of Mr. McDonough's own manufacture. On the last bill we used regular printing inks, specially selected for the work, furnished by Mr. McDonough.

Cross-Examination by Mr. Freeman.

X Q. 16. What connection have you with the Panorama Printing Company ? A. I was one of the proprietors.

X Q. 17. What is the general character of the work done by that company ? A. Commercial printing.

X Q. 18. Any particular lines of commercial printing ? A. No, just general job printing.

X Q. 19. By that you mean, do you, general type printing, or do you include other kinds of printing, upon

stones, plates or cuts? A. We do no stone work in job printing. We print from type, electrotypes, copper-plates and such like, and that is the character of the printing done by the Panorama Printing Company.

X Q. 20. Then you are familiar with printing from engraved copper-plates and similar plate printing, are you? A. There is a difference in an engraved copper-plate. A plate made for letter-press printing, such as those used by Mr. McDonough, I am thoroughly familiar with.

X Q. 21. Did that company do much work from plates of this character? A. Do you mean plates such as Mr. McDonough's?

X Q. 22. Such as referred to in your last answer? A. That is the only work of the kind I recollect doing. It is a peculiar kind.

X Q. 23. You mean that this is the only work you did on a plate made for letter-press printing? A. Oh, no; I mean this particular line of work.

X Q. 24. Have you seen either of the plates referred to in question 6 and question 8, between the times when you say you did the work on those plates and to-day? A. I have seen them; I believe I kept the plates at my office for some little time, and I have seen them up here. Not for any special purpose outside of the regular business.

X Q. 25. How long did you keep the plates at your office, if you remember? A. I don't know exactly—the first one probably a week, it might have been more. The second one I don't recollect; it was some little time though; it might have been more than a month.

X Q. 26. What then became of them? A. I delivered them to Mr. McDonough.

X Q. 27. When did you next see them, and where? A. I believe it was here, something over a year ago; I

was up seeing Mr. McDonough about some work, and saw the plates lying in his work-room.

X Q. 28. You are confident, are you; that these two plates are the identical ones worked on by you at the time stated? A. Perfectly.

Re-Direct by Mr. Banning.

R-D. Q. 20. Please state whether at the time you did the printing, in December, 1893, from this electrotpe before you, Mr. McDonough had another electrotpe like this, from which you also did printing in the same manner? A. I think there were two electros and one etch., if I remember correctly.

THOMAS W. ROBERTS, JR.

OTTO SCUDER, a witness produced, sworn and examined on the part of McDonough, in answer to questions by Mr. Banning, deposed and testified as follows:

Q. 1. State your name, age, residence and occupation? A. Otto Scuder; age, twenty-two years; residence, 487 Lincoln street, Chicago; and occupation, engraver.

Q. 2. Do you know James W. McDonough, here present? A. Yes, sir.

Q. 3. Did you ever do any work for him? A. I ruled a tint on metal for him.

Q. 4. About when was that? A. It was previous to the summer of 1892, or during the summer of 1892.

Q. 5. Who were you working for at that time? A. Mr. William Bertram.

Q. 6. When did you quit working for Mr. Bertram? A. In the summer of 1892.

Q. 7. And you say this was before you quit working for him? A. Yes, sir.

Q. 8. Look at this plate which I now show you, marked "McDonough Exhibit Ruling Plate, May, 1892," and state what you may know about it. A. I don't recollect the plate; I don't recollect the size of it, or what it looked like. All I know was it was a metal plate ruled with a fine tint.

Q. 9. What do you mean by "tint"? A. Parallel lines engraved into the wood or metal.

Q. 10. About how fine were the lines? A. I don't know how fine these were, but I know they were finer than we usually use in our business.

Q. 11. Why did you make them finer than usual? A. Because Mr. McDonough wanted them as fine as the metal could hold them.

Q. 12. Did he tell you what he wanted them for? A. No, sir, he did not, or I don't recollect that he told me that.

Q. 13. Look at the lines on this block that I have called your attention to, that have not been plowed up by a tool, and tell us how they correspond to the lines on the block which you made for Mr. McDonough? A. As near as I can recollect, they are about the same.

Q. 14. What would you say was the general size of the block that you made for Mr. McDonough? A. I would say that it was about the size of five by six, or something like that—perhaps less than that. I don't recollect exactly. It was less than five by six; that was what I meant to say.

Cross-examination waived.

OTTO SCUDER.

WILLIAM BERTRAM, a witness sworn and examined on the part of McDonough, in answer to questions by Mr. Banning, deposed and testified as follows:

Q. 1. State your name, age, residence and occupation.

A. William Bertram; age, fifty-nine years; residence, Edison Park, Chicago; and occupation, engraver.

Q. 2. Are you acquainted with Mr. James W. McDonough, here present? A. I am.

Q. 3. Did he ever have any work done in your place of business, 56 Fifth Avenue? A. Yes, sir.

Q. 4. What kind of work was it that he had done there, if you remember? A. Different kinds of work, but mainly this tint work in later years.

Q. 5. Look at these two plates that I now show you, marked "McDonough Exhibit Ruling Plate, May, 1892," and "McDonough Exhibit Ruling Plate, December, 1893," and state what you know about them. A. Both of these plates were done in my office.

Q. 6. Who did them? A. This one (referring to the large one) I think I did myself.

Q. 7. Who did the smaller one? A. It is hard for me to tell now whether the young man did that who was a witness here, or I may have ruled it myself.

Q. 8. Who do you mean by "the young man"? A. Scuder.

Q. 9. When did Scuder cease working for you? A. I think it was in the fall of 1892.

Q. 10. Did Mr. McDonough tell you what he wanted the work for, if you remember? A. He didn't give me much information.

Q. 11. How was the work that you did for Mr. McDonough as compared with other work that you did in your

place, so far as the fineness of the lines is concerned? A. That was about one hundred lines to the inch.

Cross-examination waived.

WILLIAM BERTRAM.

FRANK L. EASTMAN, a witness produced, sworn and examined on the part of McDonough, in answer to questions by Mr. Banning, deposed and testified as follows:

Q. 1. State your name, age, residence and occupation. A. Frank L. Eastman; age, forty-five years; residence, Chicago, Illinois; and occupation, insurance broker.

Q. 2. Are you acquainted with James W. McDonough, here present? A. Yes, sir. I think I became acquainted with him in 1872.

Q. 3. What relation do you sustain toward him? A. A brother-in-law.

Q. 4. State briefly, if you know, what has been the state of Mr. McDonough's health for some years past. A. He has never been in good health since I have known him.

Q. 5. To what extent, in a general way, has his business or occupation been interrupted or interfered with by ill health for the last few years? A. He has frequently been obliged to remain away from business for several days at a time, and a number of times for much longer. I remember one time that he was away from business for several months.

Q. 6. During the last few years do you know of his being under medical treatment? A. Yes; on several occasions.

Q. 7. You may state whether in conversation Mr.

McDonough has ever said anything to you about his color photograph work. A. Yes; he has talked with me about photographing in colors ever since I first became acquainted with him. I have lived in the same house with him since 1873, and at that time he was engaged in work on this photographing in colors, and I have seen his work almost constantly since then.

Q. 8. You may state whether or not you ever saw any work in which the colors were arranged in lines? A. Yes, sir; I have.

Q. 9. About when did he show you any work of that kind? A. The first time he called my attention to color work in lines in connection with his photograph experiments was in 1892, between February and September.

Q. 10. Where was that? A. In my office, 138 La Salle street, Chicago.

Q. 11. What was it that he showed you at that time, as far as you now remember it? A. I think it was two pieces of paper or celluloid, with lines ruled on them, and he held them up in front of me and worked them back and forth, and the effect was a rapid changing of colors—I don't know exactly how to describe that—but it was something that I had never seen before, and it interested me very much.

Q. 12. Going back, say, fifteen years, you may state where Mr. McDonough has been at work a good portion of his time? A. During the past fifteen years, while in the city, he has worked a great deal of the time in the house where we both lived.

Q. 13. During that time has Mr. McDonough's business been in Chicago all the time, or elsewhere for part of the time? A. Part of the time he has been in New York City.

Cross-examination waived.

FRANK L. EASTMAN.

AUGUSTUS MAAS, a witness produced, sworn and examined on the part of McDonough, in answer to questions by Mr. Banning, deposed and testified as follows:

Q. 1. State your name, age, residence and occupation.

A. Augustus Maas; age, fifty-nine years; residence, Maywood, Chicago; and occupation, engraver.

Q. 2. Do you know James W. McDonough, here present? A. Yes, sir.

Q. 3. How long you known him? A. About twenty-five years.

Q. 4. What, if anything, do you know about Mr. McDonough working on the subject of color photographs?

A. Mr. McDonough came to my office in 1892, at the Caxton Building. He brought some paper with ruled lines on it for me to—wanted to know if I could rule plates for him for the purpose of photographing. I had done some work for Mr. McDonough before and he thought I was still in possession of machines to do that work. He explained to me what he wanted it for—for photographing in colors. He gave me a description of about what he was doing. I couldn't remember all of the details of what he was going to do with it, but he told me it was for photographing in colors, and that was what he wanted these lines for.

Q. 5. About what time of the year 1892 was it that he came to your office in the Caxton Building, as you have described above? A. It was in the summer, before August. I don't know exactly the date, or the exact time. As near as I can recollect, it was in June or July.

Q. 6. Do you remember when it was that you moved away from the Caxton Building? A. It was shortly after August, 1892.

Q. 6½. Do you remember how many colors were on

the piece of paper that Mr. McDonough brought you? A. There were three colors, if I remember right. He spoke of it—I remember that—as being the three colors, blue, red and green, if I remember right.

Q. 7. Were the colors which were ruled on this paper in large or in fine lines? A. In fine lines.

Q. 8. Did Mr. McDonough tell you about how fine he wanted the lines on the plates, to rule the colors on the paper? A. He spoke about it, but I can't remember exactly how many lines there were to be to the inch.

Cross-examination waived.

AUGUSTUS MAAS.

GEORGE J. KLEIN, a witness produced, sworn and examined on the part of McDonough, in answer to questions by Mr. Banning, deposed and testified as follows:

Q. 1. State your name, age, residence and occupation.

A. George J. Klein; age, forty-five years; residence, 305 Chestnut street; and occupation, photographer.

Q. 2. Are you acquainted with James W. McDonough, here present? A. Yes, sir.

Q. 3. How long have you known him? A. I knew him shortly before the fire of 1871.

Q. 4. Did you ever do any work for him? A. Yes, sir; for a number of years I have done work for him now and then.

Q. 5. Were you ever in his employ? A. Yes, sir.

Q. 6. When and where was that? A. In New York City; that was in the month of August, 1881.

Q. 7. What were you doing for him during the month of August, 1881? A. Making negatives principally, copies of pictures, colored work. Principally colored pictures that we copied.

Q. 8. Did Mr. McDonough ever show you anything in the way of colored photography while you were working for him in August, 1881? A. He did; showed me different results.

Q. 9. Please state whether or not he ever showed you anything in colored photography in which lines were employed? A. He did.

Q. 10. When was this? A. It was in New York, in 1881; in August, while I was there.

Q. 11. Please explain a little more in detail, if you can remember, what Mr. McDonough showed you in this line. A. He showed me results on paper and glass in colors, natural colors, pictures on paper and glass. One seemed to be on paper and one on glass.

Q. 12. Were these the ones that you have referred to in which lines were employed? A. The one on glass seemed to have lines employed.

Q. 13. State whether Mr. McDonough entered into any detailed explanation about the matter. A. At different times we had conversations about the matter, both here and in New York.

Q. 14. What, if anything, did Mr. McDonough say in those conversations about using lines for the arrangement of the colors? A. I wouldn't be able to repeat any conversation, because I did not consider it necessary to remember it.

Q. 15. When were the conversations that you have referred to as being in Chicago? A. They were held at different times in my place of business, where I was doing business ever since I have known him; we have had different talks about the matter.

Q. 16. Why do you say that the lines seemed to have been employed in the color work you say Mr. McDonough

showed you on glass in 1881? A. Because I thought I saw them.

Q. 17. What was the appearance of the work, so far as the lines are concerned? A. Crossed lines.

Q. 18. What was your understanding at the time about whether lines had been employed in doing the work that you saw in 1881? A. I don't know that I can answer the question any different from what I have. That was what I thought I saw on the glass.

Q. 19. Lines? A. Yes, sir.

Q. 20. Is that what you thought they were at that time? A. It was.

Cross-examination waived.

GEORGE J. KLEIN.

By agreement of counsel the further taking of testimony is adjourned until Tuesday, December 17, 1895, at ten o'clock A. M.

Tuesday, December 17, 1895. Ten o'clock A. M.
Met pursuant to adjournment. Present as before.

WILLIAM H. FOULKE, a witness produced, sworn and examined on behalf of Mr. McDonough, in answer to questions by Mr. Banning, deposed and testified as follows:

Q. 1. State your name, age, residence and occupation.

A. William H. Foulke; fifty-five years; residence, Chicago; and occupation, dealer in church furniture.

Q. 2. Are you acquainted with James W. McDonough, here present? A. I am.

Q. 3. Did you ever do any work for Mr. McDonough?

A. I did it for the company, for the Nutting Electrical Manufacturing Company, with which I was at that time connected.

Q. 4. What was the work that you did for him through the company? A. It was repairing what we call a ruling machine.

Q. 5. Look at this exhibit I now show you, called "McDonough Exhibit Ruling Machine, September, 1893," and state whether you ever saw it before. A. I did. This is the machine.

Q. 6. When was it that the work was done on this machine, as you have above explained? A. It was—I can't remember the exact time the machine was brought to the shop. He came in, however, and said that he had purchased the machine, and wanted something done to it.

Q. 7. State about the time, as nearly as you can; and in answering this question you may refer to anything that enables you to approximately fix the date when the work was done. A. My impression is that it was in the latter part of September or the first part of October, 1893.

Q. 8. State whether or not you have any bill or entry in reference to the matter, and if so, please produce it. A. I have an entry of the cash received, which he gave me at the time the machine was taken away.

Q. 9. Please read into your answer the entry that you have referred to. A. Under the head of "Cash received" I have an entry on October 23rd: "McDonough, \$1.00."

Q. 10. You may state, if you remember, whether Mr. McDonough explained to you or said anything to you at the time the work was done, or thereabouts, what he wanted the ruling machine for? A. He did. He told me it was in relation to his colored photograph work, which he had mentioned to me a good many times before.

Q. 11. Did he ever show you anything in relation to

the subject of colored photographing? A. I think not up to that time.

Q. 12. You may state whether he showed you anything at the time he was having the work done? A. He worked there on the machine after we had put the blocks on it, on a good many different days, testing, I think, different ruling pens that he tried to work on it with various colored inks.

Q. 13. Do you remember whether he ever showed you anything in which different colors were arranged? A. There was a number of ruled sheets that laid about the shop there for a long time afterwards.

Q. 14. Ruled with what? A. In different colors, dyes of some ink or something—different colors.

Q. 15. In parallel lines? A. Yes, in parallel lines.

Q. 15½. You may state about how closely the lines were arranged together, if you remember. A. They were very close indeed, but I heard him remark that it was hard for him to get a pen that would rule close enough; that seemed to be the difficulty.

Cross-Examination by Mr. Freeman.

X Q. 16. How long were you connected with the Nutting Electrical Manufacturing Company? A. I think six or seven years.

X Q. 17. When did you sever your connection with that company? A. Exactly I cannot tell, but it went into the hands of a receiver in November or December, 1893.

X Q. 18. While you were connected with the company did Mr. McDonough have work done there for him on more than one occasion? A. I think not.

X Q. 19. Did that company never do any electrical work for Mr. McDonough? A. No, it did not.

X Q. 20. What was the work you did for Mr. McDonough? A. Putting some blocks under his ruling machine, and some other little repairs that he wanted; I don't remember just what they were.

X Q. 21. What do you mean by "blocks"? A. Those wooden blocks. (Indicating on machine.) There might have been some other little things done, but I can't remember just what they were.

WILLIAM H. FOULKE.

GAYTON A. DOUGLASS, a witness produced, sworn and examined on behalf of Mr. McDonough, in answer to questions by Mr. Banning, deposed and testified as follows:

Q. 1. State your name, age, residence and occupation. A. Gayton A. Douglass; age, fifty-four years; residence, 4216 Berkeley avenue, Chicago; and occupation, merchant in photographic supplies.

Q. 2. Are you acquainted with James W. McDonough, here present? A. I am.

Q. 3. How long have you been acquainted with him? A. Personally I have known him since 1888; I have known him by reputation since 1873.

Q. 4. You may state whether or not you have ever known of his being at work on the subject of color photography. A. I have.

Q. 5. You may state whether you ever received any letter or communication in writing from him on that subject. A. I did.

Q. 6. Have you anything with you which you received from him? A. I have.

Q. 7. What is the date of it? A. April 23, 1892. Here is the letter.

Witness here produces and hands to counsel a

letter which on examination appears to be a substantial copy of the Cross letter already offered in evidence.

Q. 8. I will ask you whether you ever invited Mr. McDonough to talk before the Photographic Section of the Academy of Science. A. I have, several times.

Q. 9. Look at this letter I now show you, and state whether that is one of such invitations. A. Yes, it is.

Letter handed to the witness was the one already offered in evidence, dated April 22, 1892.

Q. 10. What answer did Mr. McDonough make to your invitation? A. If I remember rightly, he said that if his health permitted he would be glad to do so.

Q. 11. You may state whether or not Mr. McDonough ever talked with you about his work on color photography. A. He has.

Q. 12. About what was the date of any such conversations? A. I cannot fix a date, but there have been a great many times since 1888, when I first knew Mr. McDonough personally.

Q. 13. About the time that he gave you this letter, dated April 23, 1892, if he had any conversation with you, you may state the substance of it, as you may remember it. A. He gave me the account of it substantially as it is in the letter, and went over the different points of preparing this colored surface with this gelatine powder, of these various colors, or any other way of bringing them together closely, by lines or dots, or any other method.

Q. 14. How near to the date of this letter of April 23, 1892, was the conversation that you have explained above? A. I cannot state definitely; it might have been three months and it might have been six. We were hav-

ing conversations of that nature very often, nearly every time he came into the store.

Q. 15. Do you remember of calling Mr. McDonough's attention to a copy of the American Journal of Photography for December, 1894? A. I do.

Q. 16. What date in December was that? A. It is entered—December 15th.

Q. 17. I notice on page 556 the words "Gayton A. Douglass, 111 State street, Chicago, December 15th, 1894;" is that your writing? A. It is.

Q. 18. At the time you showed Mr. McDonough this American Journal of Photography of December 15, 1894, what, if anything, did Mr. McDonough take out of his pocket and show you? A. He took from a little book a small piece of what looked like mica or celluloid, and showed me that it was lined, and the lines being so small of course they could not be seen with the naked eye.

Q. 19. Were there any colors on these lines when you came to examine them? A. There was. I examined them with a little glass that I always carry with me, which magnified them.

Q. 20. Why did you, when you saw this account of Mr. Joly's work in the American Journal of Photography, call it to the attention of Mr. McDonough? A. Knowing that he was investigating the same work in color photography, I thought that it would interest him.

Cross-Examination by Mr. Freeman.

X Q. 21. How long have you been in the business of photographic supplies? A. From my boyhood up; about forty years; just forty years since 1855.

X Q. 22. Are you generally familiar with, or have you heard of, the various processes for reproducing pictures

in colors or otherwise which have been put upon the market of late years? A. I am, and have.

X Q. 23. Did you ever hear of the so-called Ives process, or composite heliochromy? About when, as you remember, did you first hear of this process? A. I think it was in 1892.

X Q. 24. Has Mr. McDonough purchased any photographic supplies of you? A. Yes; a great many.

GAYTON A. DOUGLASS.

ELSWORTH E. FLORA, a witness produced, sworn and examined on the part of Mr. McDonough, in answer to questions by Mr. Banning, deposed and testified as follows:

Q. 1. What is your name, age, residence and occupation? A. Elsworth E. Flora; age, thirty-four years; residence, Hyde Park, Chicago; and occupation, experimentalist, assisting Mr. McDonough.

Q. 2. Look at these two exhibits I now show you, entitled "McDonough Exhibits Illustrative Transparency Gate Scene and Park Scene," and state who made the negative from which these exhibits are made. A. I made these negatives of these pictures.

Q. 3. State whether they were made from nature. A. They were made from the natural scene in Southern Indiana.

Q. 4. How nearly do they represent or exhibit the natural colors of the scenes from which they were made? A. They were as near like it as I can recall from my memory of the place.

Cross-examination waived.

ELSWORTH E. FLORA.

STATE OF ILLINOIS, }
COUNTY OF COOK. } ss.

I, M. L. Price, a Notary Public within and for the County of Cook and State of Illinois, do hereby certify that the foregoing depositions of James W. McDonough, Thomas A. Banning, Thomas W. Roberts, Jr.; Otto Seuder, William Bertram, Frank L. Eastman, Augustus Maas, George J. Klein, William H. Foulke, Gayton A. Douglass and Elsworth E. Flora, taken on behalf of James W. McDonough in pursuance of notice hereto annexed, before me, at 307 Dearborn street in the City of Chicago, in said county, on the 10th, 11th, 12th, 13th, 14th, 15th, 16th and 17th of December, 1895; that said witnesses were by me duly sworn before the commencement of their testimony; that the testimony of said witnesses was written up by myself; that the opposing party was present by his attorney, George F. Freeman, Esq., during the taking of said testimony; that said testimony was taken at No. 307 Dearborn street, Chicago, and was commenced at 10 o'clock on the 10th of December, 1895, was continued pursuant to adjournment on the 11th, 12th, 13th, 14th, 15th, 16th, and was concluded on the 17th of said month; that I am not connected by blood or marriage with either of said parties, nor interested, directly or indirectly, in the matter in controversy.

In testimony whereof I have hereunto set my hand and affixed my seal of office at Chicago, in said county, this 23rd day of December, 1895.

M. L. PRICE,
Notary Public.

IN THE UNITED STATES PATENT OFFICE.

JAMES W. McDONOUGH	}	Art of Producing Colored Pictures by the Aid of Photography.
vs.		
JOHN JOLY.		

Testimony taken on behalf of McDonough this 27th day of November, 1896, before Annie C. Courtenay, a Notary Public in and for Cook County, Illinois, at the office of Banning & Banning & Sheridan, 1303 Marquette Building, Chicago, Illinois, pursuant to the annexed notice.

Present on behalf of McDonough, Thomas A. Banning, Esq., and on behalf of Joly, Richard W. Barkley, Esq.

ELLSWORTH E. FLORA, a witness produced, sworn and examined on the part of McDonough, in answer to questions by Mr. Banning, deposed and testified as follows:

Q. 1. Are you the same Ellsworth E. Flora who has already been examined in this case as a witness? A. Yes, sir.

Q. 2. In what capacity, if any, are you employed by McDonough? A. As his assistant.

Q. 3. Have you been employed in such capacity ever since your last deposition in this cause? A. Yes, sir.

Q. 4. State what your duties as such assistant have been. A. Assisting him in perfecting his color photograph work.

By MR. BARKLEY: The answer is objected to as irrelevant and immaterial and not proper rebuttal.

Q. 5. Have you read letters patent to McDonough No. 471,186 and 471,187, dated March 22, 1892, the specification of McDonough, Serial No. 533,198, and the

specification of Joly, No. 519,894, included in this interference, and count 2 included in this interference, and do you understand the method described and claimed in such patents and applications and the screen described in said count 2?

By MR. BARKLEY: The objection is made that the question is incompetent, irrelevant and immaterial and not proper rebuttal.

A. Yes, sir.

Q. 6. Have you any color photographs present which you have assisted in making and which were made according to the method described in the McDonough application?

By MR. BARKLEY: The last objections are repeated.

A. Yes, sir; I have some pictures here.

Q. 7. You have just handed me seven pictures; are they the ones referred to in your last answer?

By MR. BARKLEY: The above objections are repeated.

A. Yes, sir; they are the pictures.

Q. 8. About when were these pictures made?

By MR. BARKLEY: The above objections are repeated.

A. Some were made recently, others over a year ago.

By MR. BANNING: Counsel for McDonough offers in evidence the pictures produced by the witness, and the same are marked "McDonough Exhibits 1, 2, 3, 4, 5, 6 and 7," respectively.

By MR. BARKLEY: The aforesaid exhibits, and each of them, are objected to as incompetent, irrelevant and immaterial, and as not being proper rebuttal.

Q. 9. Have you prepared, and will you produce, a

sample of the colors or dies used by yourself and McDonough in the making of the screens used in the taking of these pictures?

By MR. BARKLEY: The above objections are repeated.

A. I have here a sample of colors used in our work.

Q. 10. Does this tank of colors which you have produced and handed me show the colors mentioned in the McDonough application under the general terms of reddish orange, yellowish green and violet blue?

By MR. BARKLEY: The above objections are repeated.

A. Yes, sir.

Q. 11. What does this reddish orange looking color in the compartment at the end of the tank represent?

A. It represents chrysoidine orange, such as spoken of in Joly's specification.

By MR. BARKLEY: The above objections are repeated as to this answer.

Q. 12. What is the cause of what I may term the somewhat cloudy appearance of the chrysoidine orange in this color tank?

By MR. BARKLEY: The above objections are repeated.

A. Caused by re-crystallization of the color.

Q. 13. I see that Joly in his specification refers to ethyl green and chrysoidine orange as the colors used for his green selecting line and water blue for the blue-violet selecting line. What, if anything, is there in this tank of colors which corresponds to these colors?

By MR. BARKLEY: The above objections are repeated.

A. All three, beginning with the violet blue, corre-

spond to the colors mentioned in Joly's specification.

By MR. BARKLEY: The answer is objected to for the reason above stated.

Q. 14. Do you mean by your last answer the three consecutive apartments of the tank, beginning with the violet-blue one?

By MR. BARKLEY: Above objections repeated.

A. Yes, sir.

By MR. BANNING: Counsel for McDonough offers in evidence the tank of colors produced by the witness, and the same is marked "McDonough Exhibit Tank of Colors."

By MR. BARKLEY: The last named exhibit is objected to as incompetent, irrelevant and immaterial to the issue, and as not being proper rebuttal.

Q. 15. Have you here, and will you produce, the original of the photograph marked "McDonough Exhibit No. 2"? A. Yes, sir; I have here a picture which is the original of color photograph No. 2, and I here produce it.

By MR. BANNING: Counsel for McDonough offers in evidence the picture produced by the witness, and the same is marked "McDonough Exhibit Original of Color Photograph No. 2."

By MR. BARKLEY: The exhibit last named is objected to for the reasons last above stated.

Q. 16. If you have present anything to illustrate the color sensations produced by revolving rapidly the fundamental colors red, green and blue, and the color sensations produced by revolving rapidly the colors termed by McDonough in his specification in this interference as reddish orange, yellowish green and violet blue, please produce it.

By MR. BARKLEY: The question is objected to as

irrelevant, immaterial and incompetent, and further, that it is not proper rebuttal.

A. I herewith hand you a little machine to demonstrate the mixing of colors above mentioned.

By MR. BANNING: Counsel for McDonough offers in evidence the device produced by the witness, and the same is marked "McDonough Exhibit Color-Mixing Device."

By MR. BARKLEY: The last named exhibit is objected to for the reasons above stated just previous to question 16.

Q. 17. What is this little strip of paper with colored pieces on it which I see on the base of this "McDonough Exhibit Color-Mixing Device"?

By MR. BARKLEY: Objected to for reasons above named.

A. The cuttings from the above color disks.

By MR. BANNING: Counsel for McDonough states that he marks on the back of the disk showing the fundamental colors the figure 1, and on the back of the disk showing McDonough colors the figure 2, for convenience of reference hereafter to such disks.

Q. 18. Have you present, and if so, produce them, any absorption color screens?

By MR. BARKLEY: The above objections are repeated.

A. I herewith hand you two screens showing this effect.

By MR. BANNING: Counsel for McDonough offers in evidence the two screens produced by the witness, and the same are marked "McDonough Exhibit Absorption Color Screens."

By MR. BARKLEY: Objected to as irrelevant and immaterial.

Q. 19. You have stated that you have read and understand the McDonough patents 471,186 and 471,187, of March 22, 1892. Have you ever made a screen according to the methods described in such patents? If so, please produce it.

By MR. BARKLEY: Objected to as incompetent, irrelevant and immaterial and not proper rebuttal.

A. I herewith hand you a specimen of screen made similar to the description in the above-named patents.

Q. 20. In what respect does a screen made in accordance with the description of the McDonough patents of March 22, 1892, referred to, differ from a screen made in accordance with the description of the McDonough specification in interference?

By MR. BARKLEY: The last objections are repeated.

A. The description in the 1892 patents differs only in the method of placing the colors, and not in the colors themselves. One speaks of colors dusted or sprinkled, the other in lines, dots or regular patterns. The colors in both are the same.

By MR. BARKLEY: The answer is objected to for the reasons above stated.

Q. 21. From your experience as the assistant of Mr. McDonough, what would you say as to the practical and successful character of the methods described in his 1892 patents and in the specification in interference?

By MR. BARKLEY: The question is objected to for the reasons above stated.

A. It is not only feasible but perfectly practical to produce any number of pictures commercially, by either process.

By MR. BARKLEY: The above objections are repeated as to this answer.

By MR. BANNING: Counsel for McDonough offers in evidence the screen produced by the witness in his answer to question 19, and the same is marked "McDonough Exhibit 1892 Patent Screen."

By MR. BARKLEY: The last named exhibits objected to as incompetent, irrelevant and immaterial and not proper rebuttal.

Cross-Examination by Mr. Barkley, without waiver.

X Q. 22. What is the definition of chrysoidine, as given in standard dictionaries, such as Webster's International? A. I do not know the definition given in the dictionaries such as above mentioned.

X Q. 23. Does not the dictionary mentioned in the last question define chrysoidine to be a yellow crystalline substance? A. I do not know how the dictionaries above mentioned define it.

X Q. 24. If one should mingle and project upon the eye light from the solar spectrum taken therefrom, at a point a little beyond the G line toward the H line of the spectrum, and also light taken from the same spectrum at a point where the wave length is 505 millionths of a millimetre, what would be the resultant hue observed? It being understood that the above-named spectral lights are not reduced in brightness by the apparatus employed to project them upon the eye. A. I am not sufficiently acquainted with spectrum analysis to state what the resultant hue would be.

X Q. 25. The books say that all visible wave lengths of nature are contained in a beam of sunlight. Have you any remarks to offer upon the accuracy of this statement? A. No remarks whatever.

Re-Direct Examination by Mr. Banning.

R-D. Q. 26. How is Mr. McDonough now; what is the state of his health?

By MR. BARKLEY: The question is objected to as irrelevant and immaterial.

A. Mentally and physically he is in a very serious condition, but he has improved considerably of late.

R-D. Q. 27. Is he able to testify at the present time as a witness in this case? A. No, sir.

R-D. Q. 28. What day, if you remember, was he taken sick? A. It was Sunday night, November 8th.

R-D. Q. 29. Has he been able to work or attend to his business since then? A. Not to my knowledge.

By MR. BARKLEY: This entire line of questions is objected to as irrelevant and immaterial.

R-D. Q. 30. How often have you seen him since the 8th inst.? A. Frequently.

R-D. Q. 31. What is the object of using some yellow as mentioned in the McDonough '92 patents, and in the McDonough specification in interference?

By MR. BARKLEY: The question is objected to as being incompetent, irrelevant and immaterial and not proper rebuttal, and for the further reason that the 1892 patents referred to themselves give the reason why the yellow is added.

A. The yellow is added to the red and green, as spoken of in these patents, so as to produce a yellow when red and green as used are the only two lines or dots or figures that are shown in the resulting picture; also the yellow absorbs any blue light or blue reflected light that may be shown in the original subject photographed.

By MR. BARKLEY: The last objections are repeated.

R-D. Q. 32. Aside from technicalities, would the color photograph of an object which contained a yellow tint show the yellow in the photograph unless some yellow were used in the colors on the screen?

By MR. BARKLEY: The last objections are repeated.

A. No.

R-D. Q. 33. What was this photograph No. 7 taken from? A. The lily pond in Washington Park, in this city.

ELLSWORTH E. FLORA.

THOMAS W. ROBERTS, Jr., a witness produced, sworn and examined upon the part of McDonough, in answer to questions by Mr. Banning, deposed and testified as follows:

Q. 1. Are you the same Thomas W. Roberts, Jr., who testified once before in this case? A. Yes, sir.

Q. 2. Please look at your answer to questions 4, 5, 6 and 7 of your former deposition. Have you done so?

By MR. BARKLEY: The question is objected to as improper, for that the witness should testify from memory.

A. Yes, sir.

Q. 3. In your answer to question 7 it appears that in your other deposition you mentioned the colors red, yellow and blue as the colors which you say you ruled upon the plate mentioned in your answer. Please state what the fact is as to the use by you of any other color or colors in ruling such plates.

By MR. BARKLEY: The question is objected to as irrelevant, immaterial and not proper rebuttal, and for the further reason that it is leading and sug-

gestive and seems to be an attempt on the part of McDonough to make his testimony fit the Joly invention after he has learned from the testimony in behalf of Joly and the Joly exhibits what that invention is. The alleged error or incompleteness in witness' testimony was just as obvious on the day it was given as it is now, provided McDonough possessed the knowledge at that time that he possesses now.

A. If question 7 had been put different it would have saved us this bother. We used the colors red, yellow and blue, but they were afterwards changed and the yellow and blue were mixed together to form a green, not being able to get a printing ink of the peculiar shade of green needed for the experiment, but afterwards we used an ordinary green, but I don't know whether it gave satisfaction or not, and therefore did not mention it in my other deposition.

By MR. BARKLEY: The answer objected to as irrelevant, immaterial, incompetent and not proper rebuttal.

Q. 4. When you used the ordinary green that you have mentioned for ruling the plate, what other colors were used with it?

By MR. BARKLEY: The last objections are repeated.

A. Red and yellow, making red, yellow and green.

Q. 5. How many different kinds of colors did Mr. McDonough use in those experiments in ruling the plate in May, 1892?

By MR. BARKLEY: The above objections are repeated.

A. I think we only used the three colors; I don't rec-

ollect any others. But we tried different shades; the colors, though, were the red, yellow and blue.

Q. 6. What interest did you have in the work in May, 1892, beyond that of the employé of the Panorama Printing Company who was directed to do the work?

By MR. BARKLEY: Objected to as irrelevant and immaterial.

A. I was one of the partners of the Panorama Printing Company, and beyond pleasing a customer had no interest whatever.

Cross-examination waived.

Q. 7. After you had left the stand and read over your deposition you said something about your answers having been limited to the 1892 plate. I have therefore recalled you to ask you in reference to the work that you did on the 1893 plate mentioned in your question 8. State in what respect the work which you did in December, 1893, differed from that which you did in May, 1892.

By MR. BARKLEY: Objected to as irrelevant, immaterial and not proper rebuttal.

A. In 1893, in December, the work differed only in mixing the yellow and blue and forming a green; after having printed first with red, yellow and blue, the blue was left out and the green substituted.

Cross-examination waived.

THOMAS W. ROBERTS, JR.

STATE OF ILLINOIS, }
COOK COUNTY. } ss.

I, Annie C. Courtenay, a notary public within and for the County of Cook and State of Illinois, do hereby certify that the foregoing depositions of Ellsworth E. Flora and Thomas W. Roberts, Jr., were taken on behalf of James W. McDonough in pursuance of the notice hereto annexed, before me, at the office of Banning & Banning & Sheridan, 204 Dearborn street, Chicago, Illinois, in said county, on the 27th day of November, 1896; that each of said witnesses was by me duly sworn before the commencement of his testimony; that the testimony of each of said witnesses was written out by Laura C. Collins in my presence; that the opposing party, John Joly, was present by his attorney, Richard W. Barkley, during the taking of said testimony; that the taking of said testimony was begun at 10 o'clock A. M. and concluded on the said 27th day of November, 1896; and that I am not connected by blood or marriage with either of said parties, nor interested directly or indirectly in the matter in controversy.

In testimony whereof I have hereunto set my hand and affixed my seal of office at Chicago, in said county, this 30th day of November, 1896.

ANNIE C. COURTENAY,

[SEAL.]

Notary Public.

IN THE UNITED STATES PATENT OFFICE.

Interference No. 17,403.

JAMES W. McDONOUGH	}	The Art of Producing Colored Pictures by the Aid of Pho- tography.
vs.		
JOHN JOLY.		

Before the Examiner of Interferences.

Testimony on the part of McDonough taken in rebuttal, before Annie C. Courtenay, a Notary Public in and for Cook County, Illinois, at the office of Banning & Banning & Sheridan, 204 Dearborn street, Chicago, Illinois, this 4th day of January, 1897, pursuant to the annexed notice and stipulation.

Present on behalf of McDonough, Thomas A. Banning, Esq., and on behalf of Joly, Richard W. Barkley, Esq.

JAMES W. McDONOUGH, a witness produced for and examined in his own behalf, in answer to questions by Mr. Banning, deposed and testified as follows:

Q. 1. Are you the James W. McDonough who has already testified in this interference, and whose application, No. 533,198, is involved in this interference? A. I am.

Q. 2. What has been the state of your health during the fall just past?

By MR. BARKLEY: This line of questions objected to as irrelevant and immaterial. This objection is made once for all.

A. It has been very poor. My work of any kind has been very irregular.

Q. 3. What was the nature of the attack you suffered in the early part of November last? A. Some several

months ago I began to suffer from nervous and mental exhaustion, and I found it almost impossible to work. I knew it was really necessary to carry on this examination, and I believe the date was set in the Patent Office to commence the evidence in rebuttal. I tried to work very hard to collect my ideas and arrange them in proper order, and worked for about six hours on, I think it was the 8th of November, and exhausted myself very much. This was followed by a stroke of paralysis. It culminated in about three days. At that time I could hardly walk; I could not hold anything in my right hand whatever; my head was numb on one side and my tongue so paralyzed that I could hardly speak. I was confined in bed at one time about six days and at another time about ten days.

Q. 4. What is the condition of your health at the present time? A. I have recovered to some extent. I can write, but not very legibly nor for any length of time. I cannot talk very long at a time without difficulty. I am here against the advice of my physician and friends. I am told that I am liable under mental exertion to a new hemorrhage of the brain, which may prove serious.

Q. 5. In answering question 24, Joly said that he considered that his method was founded upon color measurement and theory. What have you to say as to this being the true foundation of the invention involved in this interference? In answering this and any subsequent question referring to Joly, Fowler or Hallock, you will understand that I am referring to the depositions given by such parties, respectively, in this interference. You will also understand that you may proceed leisurely and with due regard to your health in making your answers.

BY MR. BARKLEY: The question is objected to for want of foundation.

BY MR. BANNING: In view of the objection, you may

preface your answer by stating whether or not you have read the depositions of the parties to which I refer, and in your answers you may refer to them and such other matters as you may consider necessary. A. I have read the testimony of Joly, Fowler and Hallock. I was present at the time each of these depositions was taken. I have studied them as fully as I was able to do.

I will say in answer to the question that a knowledge of color measurements and theories is highly desirable to the inventor in color photography, but the significance placed by Joly upon one single result obtained in the mapping or diagrams of the color sensation curves is altogether misleading. Taking the diagrams of Koenig and Maxwell amongst others, Abney, an authority introduced by Joly in this case, says on p. 47 that

“As a matter fact, Clerk Maxwell chose colors which do not best represent the color sensations. The red is too near the yellow, as is also the green. The blue should also be nearer the violet end of the spectrum than the position which he chose for it.”

And that he does not accord with Koenig.

On page 49 Abney says:

“The next diagram (Fig. 16) of color sensation is due to Koenig who investigated the subject with Von Helmholtz. By a modified method, which, perhaps, need not be explained in detail here, he produced them, and they must be apparently not far from the actual state of things, supposing this theory be proved to be true. For my own part I am under the impression that the positions of the colors which most nearly approach the color sensations might be slightly altered in regard to the green and the blue for reasons that will subsequently be given when the later experiments of General Festing and myself come to be described.”

In making these diagrams just referred to the spectro-

scope is an instrument by means of which the investigations are made; the sensations produced by the wave vibrations of light, the subject to be investigated. The results obtained and the diagrams depend altogether upon illumination. With a low illumination, either of the beam of sunlight used or a closer aperture of the spectroscope slit, only three colors can be seen, red, green and violet. At this point the color sensations coincide with the fundamentals, that is, with such conditions as will satisfy count II of the interference, and a proper diagram of the curves of the fundamentals is in accord with the sensations of the nerve fibrils. As the illumination is increased either by changing sunlight or by increase of width of the slit of the spectroscope, the curves change their shape in proportion to that increase, extending more and more towards the point of highest illumination, and beyond that until at last the curve of each sensation entirely overlaps the others and we have very little of a visible colored spectrum. The height of illumination selected by each investigator is arbitrary, and, for instance, is obviously different in the investigations of Maxwell, Koenig and Rosenstiehl. Any point of illumination selected will give a diagram in accord with color sensations and theories, from strict fundamentals to entire obliteration of color, and Joly, when he says in his application in interference that

“One line *b* will so sift the light passing through it that the sensitive film beneath will be affected in a manner corresponding to the manner in which (according to color measurements and theory) the red sensitive nerves in the human eye are affected by the various wave-lengths of the spectrum,”

merely makes a statement which applies to any set of lines ruled in reddish orange, yellowish green and violet blue of whatever depth, of which the effect upon the eye,

when they strike it simultaneously, is a white or a neutral gray. A diagram such as that of Koenig's, while scientifically very valuable, could not be used if it were necessary to have absolute standard accuracy in the transmissions of light through and by means of a certain selection and depth of pigment for a screen, for if the illumination of the object to be photographed did not accord with the illumination of the spectrum while these diagrams were being made, it would be incorrect. It is practically impossible to keep the illumination of the object photographed in accord with that of the sunbeam used in investigation. We seldom use actual sunlight for exposures. The colors of the spectrum are constantly shifting, vanishing and reappearing, and the sensation curves changing under changing luminosities and conditions of the atmosphere. The spectral yellow, which is at any time a very small area, at times vanishes. I have in good light at times failed to find it. The hues change or shift their places independently of the Fraunhofer lines.

Church, an authority introduced by Joly, says, page 146, section 119:

“If we first obtain a pure, bright solar spectrum, and then gradually reduce its luminosity, we shall notice these two kinds of change in the colours, namely, a shifting in the position of the hues and a selective reduction or even extinction of them. The red will invade the orange, so that even the line D is bordered by a sort of red-lead hue; the green will extend towards the blue-green in which the F line is now included, and the pure blue will contract. We shall then describe the spectrum as containing nothing but red, green, violet.”

These changes are gradual. It follows that the action of the primary rays is not extended at this time to neighboring fibrils in the eye, and the curves of the sensation

diagram do not overlap. Rood, an authority introduced in my former deposition, says, page 23:

“The hues of the spectral colours change very considerably with their luminosity; hence for these experiments an illumination was selected such that it was only comfortably bright in the most luminous portions of the spectrum, and this arrangement retained as well as possible afterward.”

Abney says, on page 105:

“This extinction of color is one which often occurs, but is seldom noticed. The figure tells us that the orange is about the last colour of the spectrum left, some of the others still appearing as greys. The next to retain its colour is the green, and the most rapid to lose them are the red and violet. It must not be supposed that the colours remain of the same hue up to the time that they vanish. Pure spectrum red (red sensation) remains the same up to the last, but the scarlet becomes orange, and the orange yellower, and the green bluer.”

Rood says, on page 190:

“It follows from what has just been said that photometric comparisons of the brightness of differently coloured surfaces, if made under bright daylight, will no longer hold good in twilight, and that consequently we cannot under a certain illumination establish photometric relations that shall hold good under all other illuminations.”

Abney says, on page 46:

“No experiments, however, were considered good unless the sun remained uniformly bright during the whole series of experiments.”

It would seem that a better knowledge of the theories of color sensations and curves should be obtained than that disclosed by Joly in his testimony.

My invention is strictly founded upon a knowledge of color measurements and theories which cover all points

according to the theories of Young and good authorities. One would have a difficult task following the different color curves of sensation with tri-colored screens, which would require a separate screen, made not only to suit each different photographic plate, but each varying degree of illumination of the object to be photographed during the day. It would be an absurd task. It is to be accomplished in another way, that is, by the use of auxiliary plain colored screens, which have long been known to those skilled in the art, and by means of which the illumination of each separate color—that is, hue—may be regulated.

I wish to refer to an exhibit already introduced as “McDonough Exhibit Absorption Color Screens,” to show that three colors, reddish orange, yellowish green and violet blue, may be placed upon paper and glass of such a depth that each will mutually absorb the colors transmitted by the others, and that red and green, thus mutually absorptive, will transmit yellow, and that the yellow will not absorb the red and green. I have here a spectroscope by means of which these colors may be tested by placing the junction of two glass pieces across the slit of the spectroscope. The spectroscope will be so arranged, according to the focus of my eye, as to show the Fraunhofer lines. It may be seen that there is a dark space between the two colors and that they will not overlap when thus viewed. By closing the spectroscopic slit this dark space will become larger; by opening the spectroscopic slit these colors will overlap each other to any degree desired, showing that the sensation curves depend entirely upon illumination, and that they may be regulated by regulating the illumination. The absorption may be seen in a way by laying the glass screen upon the paper card having upon it the same colors.

It must be remembered that the spectral yellow is a color of very small area and, I think, never seen in nature, except when separated by means of the spectroscope or some analogous method, and that the yellows of pigments will pass through and be transmitted by reds and greens, which will mutually absorb each other to such an extent that a picture obtained from the use of these screens will show the yellow in a very natural way. There is altogether too much stress placed upon the photograph of the spectrum, for commercial work, although it is desirable to photograph it, and with the McDonough colors, screens and methods the best spectra may be made or imitated. Hallock, Joly's witness, says that pictures of yellow of natural objects may be obtained by the use of screens even in the fundamentals (Koenig's), which, of course, accord with count II. (See answer to question 40 in Joly's testimony; see Hallock's answers to cross-questions 259 and 260.)

BY MR. BARKLEY. All that part of the answer^x of the witness relating to the "McDonough Exhibit Absorption Color Screens" is objected to as being irrelevant and immaterial and not proper rebuttal. All that part of the answer of the witness relating to the theory of the McDonough invention, so-called, involved in this interference is objected to for the same reasons.

Q. 6. Joly, in his deposition, has a great deal to say about a "faithful" picture, and says, in answer to question 129, that the true photo of a girl, and some others, were faithful pictures, or faithful reproductions of nature. Can Joly, by strict adherence to his theory and procedure, as developed in his application in interference and in his testimony, produce a faithful picture? Please state

your views in full on this point, if you so desire.

BY MR. BARKLEY: The question is objected to for want of foundation, and as irrelevant and immaterial.

Recess for lunch.

A. I have worked and experimented upon this process of producing colored photographs by the use of multi-colored screens off and on for quite fifteen years. I have taken photographs of the spectrum. I constructed a spectrum apparatus myself. I have had a large experience in this way, and some considerable experience in what is called tri-color process work, supposed to be the invention of one Ducos-Du Hauron. I have essayed to produce pictures, using a viewing screen made according to the colors laid down in Joly's specification of the application in interference.

Joly cannot make a faithful picture by adhering to the theory and instructions as laid down in his application and testimony. He speaks of the use of a taking screen made from the dyes chrysoidine, chrysoidine and ethyl green and water blue, to conform to certain indefinite qualifications, and a viewing screen of fundamentals, red, green and blue, as approximating the lithium line of the spectrum for the red; to the green of the E-line region of the spectrum for the green, and to the lapis lazuli for the blue. In his testimony, in answer to question 73, he says:

“The viewing colors are selected according to the spectral tints at as nearly as possible the C red, the *b* green and a violet at G, or a little to the H side of G.”

It must be remembered that the picture under consideration is made from a positive photograph laid over this viewing screen. The picture is a *distinct object* from either the taking screen, the negative or the object photo-

graphed. No other color is present than the three colors above specified. Joly cannot reproduce intermediate tints faithfully with these colors. Let us take the yellow line near D. This is a color vibration not represented in his viewing screen. *It is not resolvable into red and green by any means.* This vibration cannot be reproduced by the synthesis of primary rays or any mixture of such lights or the use of the tri-colored screens for viewing, used according to the interpretation of Joly or Ives. A correct proportional transmission, according to the sensation curves, will not correct or obviate this natural defect, as a higher illumination only introduces white and further destroys the purity of the intermediate colors.

The vibrations of the spectral yellow occupy the intermediate space between those of the red and green and are either too short or too long and do not affect the red or violet as do those of the red and green, which are nearer to the ends of the spectrum. A good "imitation" may be made by combining in the eye the effect of the transmissions of yellow which pass through the red and green areas when viewed through a McDonough screen. It is not reproduced in the "Joly Exhibit True Photo of Spectrum," and this yellow is made by the synthesis of red and green as is only an imitation occupying the space of the yellow spectrum line. To assume that the color is reproduced in the picture is misleading. This assumption is reiterated and seems to pervade the entire testimony of Joly. A fourth, or other line, representing that intermediate line, would be necessary. This is recognized in the McDonough patent of 1892. The yellows produced are always a compound of the red and green vibrations transmitted by the viewing screen, and are complex representations of these colors.

Church says on page 20:

“But there are many compound yellow lights—lights which give us, as the sum of the simultaneous visual impression of their several components, a sensation of yellow not to be distinguished by the brain from the simple yellow of the spectrum. Such a compound yellow may be formed by throwing on the same portion of a screen a part of the red light and a part of the green light of a pure spectrum. Similarly there is a pure and simple blue in the spectrum, but a blue indistinguishable from this in hue may be obtained by mingling green and violet lights.”

Church says on page 114, six lines from the bottom:

“All the methods of obtaining yellow from the combination of the light from red and green pigments yield a hue which is disappointing in luminosity, and would be called a greyish-yellow.”

Church says on page 73:

“By combining red and green rays by means of overlapping spectra, by rotating radial sectors of red and green painted surfaces, or of red and green glass, and by Lambert’s method of combination (see section 71) we may produce the sensation of yellow. True, the resultant yellow never approaches in brightness and saturation the spectral yellow; it possesses but a moderate brightness and purity even when formed from overlapping spectra, and, when obtained by rotating disks or by Lambert’s method, is no better than a yellowish-grey.”

And just preceding this:

“In this yellow of the spectrum the greatest brightness prevails; it lies between the green and the red; it is undoubtedly produced by pure rays, and is not, in its physical origin, a compound.”

These yellows (intermediate hues) thus produced by the Joly theoretic viewing screens, are never equal to the spectral yellows and will be represented by grays. This

fact is spoken of in the McDonough 1892 patent and in the Cross letter, and the method given to correct the defect. Without this correction no fairly correct picture can be expected, because no combination of the red and green light, according to the primaries adopted by Joly, will furnish a yellow as high in saturation or illumination as the red, green and blue-violet of the spectrum or other object to be photographed. This means a loss of yellow and a purple or violet tone to the pictures and a general disturbance. This, I think, is noticeable in the military picture, Joly exhibit, and the picture of Mr. Dixon, Joly exhibit. I have had the pleasure of meeting Mr. Dixon. Although in these pictures the colors of the viewing screens are not those given by Joly in his testimony or required by his specification, for he has ruled the lines very light and unconsciously departed from the colors he has laid down, the red being of a bluish tint nowhere found in the spectrum and the green a very much more yellow hue. This green is usurped from the McDonough viewing screen. In the "Joly Exhibit True Photo of a Spectrum," by comparison with the spectroscope, it will be seen that the red is an altogether different color from that of the spectrum, and that there is no orange that I can find whatever. Joly, by ruling these lines light, has moved the predominant transmissions towards the point of higher illumination. Joly, apparently, has no knowledge of this branch of the subject—that is, of illumination.

I have here an exhibit introduced in the deposition of Mr. Flora, called "McDonough Exhibit Color Mixing Device," which is made somewhat in the shape of a "Maxwell color-box," but arranged to show the effects of the colored lines of a tri-colored screen. Each color is a strip in the shape of a portion of a circle, and is ar-

ranged so as to show the mixture of the red and green to form yellow, and the green and the violet to form blue. The colored strips are pasted upon two circular black disks. Of one the colors are a reddish orange, yellowish green and violet blue. On the other the colors are a full red, full green and somewhat darker violet blue. By rotating the disks by machinery provided, it will be seen that the reddish orange and yellowish green will produce a good yellow, and that the red formed by the full red and full green is hardly to be recognized as a yellow. It also shows the effect of lowering the illumination of all the colors used. As the disk rotates, the reddish orange becomes a full red, the green becomes a fuller green, and the violet blue a full violet. This is the exact effect that occurs in the picture, and from this effect come the full reds, full greens and full violets needed in the picture. This lower illumination destroys the effect of the fundamentals of Koenig, as shown on the other disk.

BY MR. BARKLEY: The answer is objected to as irrelevant, incompetent and immaterial, and as not being proper rebuttal.

Q. 7. In answer to questions 26 and 43 and others, Joly refers to Ives and his process, claiming to found his, Joly's, process upon that of Ives, and makes comparisons. When did you become acquainted with Ives' theory, and how far do you find the process of Joly to coincide with that of Ives? Please answer as fully as you may desire, making such explanations and comments upon the Ives theory as you may consider necessary to elucidate your answer.

BY MR. BARKLEY: The question is objected to for the reasons above stated and for want of foundation.

A. In my former deposition I said that I had been

acquainted with the Ives process probably soon after 1890, and said that I thought that the Ives process represented an important or valuable contribution to the art of heliochromy at the time, but that Mr. Ives entered into a controversy with other people who did not think so. I have thought since that time until to-day that I understood the Ives process. The Ives process upon which Joly bases his theories is very different from Joly's. In the Ives process three different negatives are taken through three different plain colored screens, *allowing different manipulation, exposure and development*. The use of compound screens, that is, auxiliary screens, is deemed necessary. Then three transparencies are taken from the three negatives, also allowing different exposure and development. In the case of the projection of the image upon the canvas by three magic lanterns, the three different lights will also be manipulated, thus changing the relative intensities and hues or colors. The finished picture always presents superposed colors or lights, no lines being used. In the process under consideration in this interference these colors always lay in a plane upon a plate, each side by side and never superposed, and, for example, where a reproduction of primary colors is sought, are always accompanied by two black opaque lines in the picture. The picture is formed by the mixture or recombination in the eye of these colors. They are combined in the picture upon the canvas in the Ives process. The Ives ideas were advanced a number of years ago, and were given sufficient publicity by the newspapers and himself in his own book and lectures, and a controversy with European scientists.

The statement made by Ives in the Photographic Quar-

terly of 1892, and referred to by Joly in his answer to question 43 of his deposition—

“The photograph made by the joint action of various different colors of spectrum rays must be seen by rays of one color only. Spectrum rays of various colors excite one fundamental sensation, but only spectrum rays of one single color will serve to represent that fundamental sensation”—

is untrue, because according to that statement no photograph made by the use of pigments in his manner and by his method could be made with complex lights or pigments. He uses the word “must” and “only spectrum rays of a single color will serve.” Spectrum rays of a single color are those, for example, of the line near C, the line near *b* and the line near G. Such pigments are impossible, and if they could be obtained would not produce a faithful picture on account of the failure to produce intermediate rays in proper proportion. The varying illuminations which may be caused in Ives’ magic lantern apparatus allows an unconscious variation not only of the intensity of light, but of actual hues or colors of the viewing screens, but I do not remember that Ives ever mentioned the subject in his writings, or had any knowledge of it whatever. I considered in 1891, and do now, that my process is an immense improvement upon that of Ives, as it has not the defect of being deficient in the production of intermediate colors through his selection of fundamentals for viewing and producing a picture, and as it makes a picture that may be seen and handled upon a single piece of paper or glass, and as a picture more faithful than anything he could obtain by his theory of viewing colors can be produced by means of one taking and viewing screen if thought advisable or requisite. I would say here that all my experience for years, until the present

day, seems to point to the fact that with a viewing screen made in my selection of colors I can take a more faithful picture than by the use of a taking screen ruled in colors to secure transmission that will only accord with some single set of curves determined by some arbitrary illumination. As an approximate method and one well known, I consider my application to cover the Ives ideas so far as they apply to the use of colored particles placed upon a screen or plate and lying in one plane, because the nature of the pigments selected by me is such as to secure the correct proportional transmissions. Joly says in answer to question 27 in his deposition:

“The correct proportional transmission of the red, green and blue-violet light is secured by the nature of the pigments upon the several minute areas of the taking screen.”

Adjourned until to-morrow morning at 9:30 o'clock.

CHICAGO, January 5, 1896.

Parties met pursuant to adjournment. Present as before. The examination of Mr. McDonough resumed by Mr. Banning.

BY MR. BARKLEY: The answer is objected to for the reasons last above stated.

Q. 8. Have you read the answers to cross-questions 148 and 164 of Joly's deposition? If so, what have you to say as to the truth or correctness of such answers?

BY MR. BARKLEY: The question is objected to for the reasons last above stated.

A. I have read the entire testimony and the answers to these questions. The question of illumination is important and should be well understood. Authorities devote very much space to it. Rood has a chapter of

twenty pages relating to it. Abney devotes large space to it. Church treats it quite fully. Without a knowledge of it no one can comment intelligently upon the subject of color photography. They cannot invent; they can do no more than copy from others, copying their deficiencies as well as their merits.

Joly says in answer to cross-question 148:

“As the thickness of the dyes increased, I would expect that the transmissions will become more and more confined to its predominant transmission. . . .

“As its thickness is increased, its transmission becomes more and more confined to the predominant transmission. . . .

“As the thickness is increased the transmission finally becomes confined to the violet-blue. . . .

“As the thickness is increased the final color is a full reddish orange.”

And in answer to question 164:

“As the thickness of the solution is increased, the transmission becomes more and more confined to the predominating transmission. . . .”

These answers are astonishing. As the films of pigments made from aniline dyes, and in fact most pigments, become thicker, they decidedly do *not* become confined more and more to the predominant rays but to altogether different ones. This fact is so prominent and so underlies all color photography after the method under consideration that it needs specific explanation as to its application. We have seen that the spectrum hues change under different illumination. (When I speak of different hues, I mean different colors.)

In Mr. Flora's deposition he produced an exhibit offered in evidence as “McDonough Exhibit Tank of Colors.” This tank leaked so that from its construction the colors became mixed as to spoil them. I here pro-

duce an entirely new set of four tanks filled with the same colors or dyes. I also produce a card upon which are pasted pieces of paper having on them the same colors applied in different thicknesses from one end to the other.

The colors in the tank and on the card are described and known as reddish orange, yellowish green and violet blue. One of the reds is chrysoidine orange and the tank is marked "Chry." to indicate this. It is a beautiful color in the tank, but on account of its too ready crystallization an unsatisfactory color to handle as a pigment. I have marked this color on the card also "Chry." to identify it. The other red color is a mixture of red and yellow which may be said to be the same spectroscopically as the chrysoidine, that is, a reddish orange. It makes a clearer and more brilliant pigment than chrysoidine. It is the mixture called for in the '92 patents and the Cross letter. It will be seen that at the top of the tanks and paper card the hues may be described as a full red, full green and full violet, the fundamentals adopted by Koenig, and which more than fulfill the requirements of count II, as may be seen by examining by means of the spectroscope. They are denser even than required by McDonough's specification under consideration for use in a viewing screen except for approximate pictures. They will not produce an entirely faithful yellow or correct intermediate hues of the spectrum. By simply ruling the colors somewhat lighter the next range of colors may be obtained, which may be termed deep reddish orange, yellowish green and violet blue, which form the fundamentals, or approximate fundamentals, that are preferable. This range of colors is termed preferable for the taking screen when it is to be used as both taking and viewing screen, a consummation very desirable under many circumstances. For instance, one may have

no extra screen nor one which will register exactly with a viewing screen. *The process is more simple.* This range also complies with the requirements of count II, as a spectroscopic test will readily show. The next range below may be placed on a line which will meet the requirements of the Koenig or the Maxwell diagrams, which, and while it will not accord in a strict sense with count II, is described by McDonough as reddish orange, yellowish green and violet blue. These are the colors described by Joly and the nomenclature copied from McDonough, Ives and Church. The McDonough application in interference calls for the denser range as well as preferable for the combined taking and viewing screen. At the very bottom of the tanks and paper card are a series of colors which may be described as orange yellow, green yellow and greenish blue, with hardly a trace in the tank of orange green or violet. This shifting of the predominant rays, with greater illumination from top to bottom, is always toward the point of greatest illumination of the spectrum—the red towards the yellow in one direction, and the green and violet towards the yellow in the opposite direction. This shifting of the predominant rays may be obtained in flat tanks or in these by simply carrying them from an ordinary lighted room to a position where they may be viewed by direct sunlight, or they may be placed before the spectroscope with a close aperture of the slit where they may absorb the light transmitted by the others, and by merely opening the slit or increasing the illumination by direct sunlight produce any degree of curve of color sensation represented by Maxwell or Koenig's diagrams, or even to a brilliancy which would be nearly white. It will be seen how large a part illumination, wholly ignored in Joly's testimony, plays in the art, particularly when it is remembered that continued or

prolonged exposure in the camera means increased illumination of the object photographed.

Church says in regard to this, page 30:

“ We shall find that transparent-coloured media do not appear of the same colour when the thickness through which the light is transmitted is made to increase or diminish. The easiest way to try this experiment is to cut half a dozen strips of coloured gelatine, each shorter than the last by a quarter of an inch. Wet the largest sheet and lay it on a sheet of colourless glass; superpose on this number two, and so on to the last and smallest strip. We might expect to find nothing more than a darker tint, a progressive purity or richness in colour, as we proceed from the single layer to the band where six layers are superposed. But this is not all that we see. We find that the hue alters as well as the richness, or comparative freedom from white. In the case of yellow gelatine (or yellow glass), *a*, in Fig. 9, will of course show the normal hue, but *b* will not be a deeper yellow: it will be orange-yellow, while *c*, *d*, *e* and *f* will verge gradually towards a full orange, or even a red.”

Rood says, in speaking of the change of yellow to dark red, on page 71:

“ There is one property which probably all substances possess which produce colour by absorption, upon which a few words must be now bestowed. If we cause white light to pass through a single plate of yellow glass, the rays which reach the eye will of course be coloured yellow. Add now a second plate of the same glass, and the light which traverses the double plate assumes a somewhat different appearance: it evidently is not so luminous, and its colour is no longer quite the same. Using six or eight plates of the yellow glass, we find that the transmitted light appears orange. If the same experiment be repeated, using a considerable number of plates of the same glass, the colour will change to dark red.”

Rood says on page 181:

“Artists are well aware that scarlet cloth under bright sunshine approaches orange in its tint; that green becomes more yellowish; and that, in general, a bright illumination causes all colours to tend somewhat toward yellow in their hues. Helmholtz, Bezold, Rutherfurd, and others have made similar observations on the pure colours of the prismatic spectrum, and have found that even *THEY* undergo changes analogous to those just indicated. The violet of the spectrum is easily affected: when it is feeble (that is, dark), it approaches purple in its hue; as it is made stronger, the colour changes to blue, and finally to a whitish-grey with a faint tint of violet-blue. The changes with the ultramarine-blue of the spectrum follow the same order, passing first into sky-blue, then into whitish-blue, and finally into white. Green as it is made brighter passes into yellowish green, and then into whitish-yellow; for actual conversion into white it is necessary that the illumination should be dazzling. Red assists these changes more than the other colours; but, if it be made quite bright, it passes into orange and then into bright yellow.”

Rood says on page 184:

“The tendency in these experiments is evidently just the reverse of what was observed where the illumination was very bright. In that case the coloured light as it increased in brightness gradually set all three sets of nerves into action, and the result was white or yellowish white; but here the action of the coloured light as it grows feebler is more and more confined to a single set of nerves. From this it results that those colour-sensations which are due to the joint action of two sets of nerves speedily diminish when the colour is darkened, and are replaced by the primary sensations, red, green or violet.”

Rood says on page 187:

“Some of the changes in the experiments just

mentioned were so great as to be quite astonishing, and might well tempt the beholder to believe that the black disk exercised some peculiar influence on the result; this, etc.”

BY MR. BARKLEY: The answer is objected to for the reasons last above stated.

Q. 9. In Joly's specification; forming a part of his application in interference, I find that he uses the words “I may also take and view the photograph through lines having the same tints; that is, tints approximating to the three primary color sensations.” What do you understand by this language as to the intention of Joly to produce faithful or only approximate pictures?

BY MR. BARKLEY: The last objections above are repeated.

A. I understand this sentence to mean that a faithful picture may be made this way with the same taking and viewing screen, for he immediately follows with this sentence in antagonism to the former one:

“Or I may secure an approximation to the original colour sensation by the use of more than three tints, as illustrated in Fig. 10, as in some methods of composite photography, and these may be the same both in taking and viewing the picture.”

He devotes considerable space to the making of these pictures from the same taking and viewing screen, showing that he thought them much more valuable than at present. He says the tints, “red, green and blue, are those of the fundamental color sensations approximating to the tint of the red, etc;” and that he “may also depart from these tints somewhat when it may be requisite to do so in order to secure that one and the same screen shall serve both for the taking and viewing the pictures.”

He does not say he will obtain an approximate or unfaithful picture or intimate anything but a faithful pic-

ture, or that the negative will not accord with the color sensations and curves, or that this approximate viewing screen will in any case cause a worthless picture. I understand that the pictures made with a separate or different taking screen will be an alternate method.

Joly says in his answers to question 40:

“It is quite legitimate to apply the terms of count II to my seeing screen. The colors required being the pure fundamental colors so far as it is possible to attain to such.”

Without this admission or assertion that approximate fundamental colors thus accord, he would have no screens fulfilling the requirements of count II, according to his testimony in this interference.

BY MR. BARKLEY: The above objections are repeated as to this answer.

Q. 10. Joly, in answers to questions 22, 100 and 101, refers to the colors described in your 1892 patents and in your specification in this interference. What have you to say of the statements contained in such answers?

BY MR. BARKLEY: The last objections are here repeated.

BY MR. BANNING: Before the witness answers the question I will offer in evidence the color-tank and color-card produced by the witness in answer to question 8. The same are offered in evidence and marked, respectively, “McDonough Exhibit Tank of Colors No. 2” and “McDonough Exhibit Card of Colors.”

BY MR. BARKLEY: The above exhibits, and each of them, are objected to as being incompetent, irrelevant and immaterial to the matter in issue.

A. In his testimony in answer to question 100 Joly says the name “blue” is hardly applicable to the pri-

mary "blue-violet" or "violet" color sensations. I will refer to Joly's application when he says:

"The tints, red, green and blue, carried by the viewing screen, are those of the fundamental color sensations approximating to the tint of the red lithium band, etc."

Church, the authority introduced by Joly, uses the name "blue" for the violet-blue sensation continually (see pages 67 and 68). Abney uses it continually (see page 32, etc.) Hallock says in answer to question 235, "I would say that blue or blue-violet, etc." It is common.

In the McDonough patents of 1892, referred to by Joly in these answers, the terms "pure red, pure green, pure blue" refer to *pigments* of which the red and green are compounded or mixed colors, so made as to present a predominance approximating to the fundamentals of Maxwell. To say that they are confined to the single predominant transmissions is an unscientific statement and would be an impossible mixture to obtain, and is misleading. The statement of the patent that the result would be a pure red, etc., means scientifically that white light is to be excluded as far as possible, because red, with yellow, green, blue and violet light forms a white. Church says on page 51, "the second constant of light is purity. A color is said to be pure when it is mixed with white." This interpretation is taken by all authorities. In the Cross letter of April 25th, 1892, referred to by Joly in answer to question 46, pigments also are referred to. The language of the Cross letter is:

"The use of yellow, which should be a little more orange than the sample, is a matter of choice. It is explained in the patent specification. In case it is not used, the yellow must be added to the green and

red, making, as near as may be expressed, ultramarine, vermilion and emerald green."

These mixtures are shown in the tank known as "McDonough Exhibit Tank of Colors No. 2" and the "McDonough Exhibit Card of Colors," omitting the pure chrysoidine. The colors ultramarine, vermilion and emerald green are the fundamentals of Maxwell, and the effect sought for is a pigment whose predominant spectral lines are as near as possible to these primaries when the yellow is used to temper them and still present a predominance in the highest point of the curve, as represented by the color curve of the sensation of each fibril under ordinary illumination. Such a pigment, as thus formed in the McDonough patents and Cross letter, would be more orange than the "scarlet red with a tint of orange like orange-red vermillion" of Maxwell (see Church, page 68, line 14), and is spoken of in the McDonough application in interference as a reddish orange. The green pigment is one formed of a mixture of green and "yellow a little more than orange the sample," and is more yellow than the emerald green primary spectral ray of Maxwell. They are *fundamentals* corrected to allow of manipulation of illumination, and at least approximate according to all authorities, and are within the range of fundamentals chosen by authorities. Hallock says in answer to question 236:

"The spectral tints of, say, the red filter would be from the deepest red in the spectrum to a point in the spectrum somewhere in the neighborhood of the yellow."

A reddish orange line in a pigment of such depth as is required will transmit a full red, orange and yellow, up to a line chosen in the pure yellow. A yellowish green will transmit all rays from that yellow to a line chosen in

the blue, and the blue violet, all of the spectrum from that blue line to the end of the visible spectrum and beyond. These will contain spectral rays of every hue except the imaginary separating lines. Amongst the immense number of pigments formed by aniline dyes that I have examined spectroscopically I have never found one that would transmit a primary color limited to a single spectrum ray—that is, a simple color. They are complex colors. Abney says, page 32: “These colors themselves (pigments) are complex colors.” On page 27: “The color of a pigment, it must be remembered, is a complex one.”

I wish to refer to the communication of July 6, 1895, in the file of the application in interference of Joly, where he says that the colors laid down in the 1892 patents are primaries. Joly says:

“It is not sought by claims one and two to cover broadly a transparent plate having thereon a pattern in the primary colors, because this construction is clearly met in the McDonough patents, but what is sought to be covered is a transparent plate having thereon a *symmetrical* pattern in the primary colors.”

Recess for luncheon.

This is an assertion or admission (taken in connection with the answer to that of question 40, which is that the approximate fundamentals or primaries accord with the requirements of count II) that the colors of the screens of the patents of '92 comply with the requirements of count II, and that the question at issue is a symmetrical screen or one made, say, in lines in the same colors as given in the patents. The colors, as I have used them in the work done under the '92 patents, are the same as I have used when working under the terms of the application in interference, and the red mixture in the tank,

showing my color, is as near spectroscopically the color in the chrysoidine tank as one could imagine. It is what would be termed in pigments a reddish orange and is well within the lines chosen by authorities for fundamentals.

BY MR. BARKLEY: The answer is objected to for want of foundation and as being incompetent and immaterial and not proper rebuttal.

Q. 11. In question 50 counsel quoted to Joly a statement from your specification in interference, in which you stated that you used, "say, reddish orange, yellowish green and violet blue," and Joly in his answer said that "the definition in question question does not agree with the definition of Maxwell, Koenig or Abney." What have you to say as to this?

BY MR. BARKLEY: The last objections are repeated.

A. It will be seen that Maxwell, Koenig and Abney differ in some degree as to the points in the spectrum chosen for their fundamentals. Others who have investigated this point and selected fundamentals are Brewster, Airy, Melloni, Draper, Helmholtz, Lambert, Young, J. J. Muller, Von Bezold, Pierce, A. M. Mayor, F. Boll, Kuehne, Rood, Wuensch, Benson, Rosenstiehl, Roechlin, Herring, Stanley Hall and others. The fundamentals have been placed from a full red (Helmholtz) to an orange (Rosenstiehl), a green from a blue green to a yellow green, a violet from a violet to a violet blue. It is largely a matter due to the illumination selected. I have not limited myself to Maxwell, Koenig or Abney. On page 76 of Church is the the following:

"The theory of Rosenstiehl (1881) differs from that of young and Maxwell in the hues and spectral positions of three fundamental colour sensations adopted. These are compared in the following table:

Maxwell.				Rosenstiehl.			
Red	$\frac{1}{2}$	from C towards	D	Orange	$\frac{3}{4}$	from C towards	D
Green	$\frac{1}{4}$	" E "	F	Yellow-green	$\frac{3}{4}$	from D "	E
Blue	$\frac{1}{2}$	" F "	G	Blue	$\frac{1}{3}$	" F "	G

"The first and second of these alterations by Rosenstiehl are, in our opinion, decidedly disadvantageous."

I find that Joly made an affidavit in this case that Ducos-Du Hauron in his French patent No. 83,061, of 1868, where he placed the fundamentals at red, yellow and blue, completely anticipated his (Joly's) invention. I will introduce that affidavit here, omitting the title, which is the title of this interference:

"John Joly, being duly sworn, deposes and says: That he is a subject of the Queen of Great Britain and a resident of Dublin, Ireland, and a professor in Trinity College, Dublin, and is one of the parties to the above-entitled interference;

"That prior and up to about the last week in February, 1896, he verily believed himself to be the first and original inventor of the subjects-matter of the above interference;

"That through his Dublin, London and U. S. attorneys and solicitors he was preparing, and up to that time he was using every effort and endeavor to prove that he was the first and original inventor of said subjects-matter;

"That prior to this time he had heard of the so-called Du Hauron method of color photography, but so far as he knew up to that date, Du Hauron used three separate and distinct plates or screens, and he never knew or supposed that Du Hauron or anyone else, prior to his invention, had used a single screen or plate having on its surface colored particles arranged in regular recurring patterns or in parallel ruled lines, or, in fact, that anyone had ever suggested the use of such a plate or screen as is covered by the issues of this interference;

"That on or about that time he received a communication from his London attorneys stating that the German Patent Office had refused to grant a patent

covering the invention set forth in the issues of this interference, on the ground that it was anticipated in French patent No. 83,061, of 1868, granting to Ducos-Du Hauron, and that he believes this letter was received by him about Feb. 24, 1896; and on that day he wrote a letter to Messrs. Foster & Freeman giving them the number and date of said French patent;

“That on Feb. 26, 1896, he received a letter from his London attorneys, a copy of which he forwarded from Dublin to Messrs. Foster & Freeman, under date of Feb. 26, 1896, together with a copy of the translation of the alleged anticipating French specification of Ducos-Du Hauron, furnished by said London attorneys;

“That under date of March 3, 1896, he cabled to Messrs. Foster & Freeman that he was starting for the United States, and that he arrived in Washington on Saturday, the 14th inst., and immediately called upon his attorneys, and had a consultation with them in regard to the pertinency of the alleged anticipating reference;

“That since that time up to the present he has been in constant communication with Messrs. Foster & Freeman and others interested in his inventions in an endeavor to find some way of overcoming the anticipation of his invention by the publication of the Du Hauron patent, but that he verily believes, and has been so advised by various counsel in New York and Washington, that the said French patent is a complete anticipation of the subjects-matter of the above-entitled interference, and that no valid patent can be granted to him or anyone else at this date for the subjects-matter of said interference or any of them;

“That, as above intimated, up to the last week in February, 1896, he had never for a moment thought he was not justly entitled to a patent for the various subjects-matter of the interference, and was using his utmost endeavors, in connection with his counsel and solicitors and parties interested therein, to maintain his rights to said invention;

“That even after reading the said French patent he endeavored to find some ground on which it could be overcome and he could still obtain a patent for

the issues of the interference, and he sought counsel and advice, not only abroad, but of his attorneys of record and other counsel in the United States, and has been uniformly advised that the French patent was a complete anticipation of the subjects-matter of the interference, and that no valid patent therefor could be granted to him or anyone else at this time in view of said patent;

“That the motion to dissolve in this case is not made for purposes of delay, but through an honest conviction that the further prosecution of the interference would be a farce and a nullity and result in no good to him or anyone else;

“That he has reluctantly come to this conclusion through his own study of the reference and from advice of numerous counsel, and that if it could be shown that the reference does not anticipate the subjects-matter of the interference, so that a valid patent could now be granted therefor, he should proceed at once with the taking of his testimony to establish his priority of invention over McDonough, the other party to this interference;

“That he had instructed his attorneys of record to proceed with the testimony, and during the last week of February, 1896, he cabled to Messrs. Foster & Freeman, at Washington, instructing them to proceed with the testimony in his behalf in the manner suggested by them;

“That at this moment he verily believes that he could show to the satisfaction of the Office that he was the first and original inventor of the subjects-matter of the interference as between McDonough and himself, and that he certainly would attempt to do so if he had not been advised and believes that it is useless to do so, as neither he nor McDonough can receive a valid patent for the subjects-matter of the interference.

“JOHN JOLY.

“Sworn to and subscribed before me this 26th day of March, A. D. 1896.

“GEO. C. BURBANK,
Notary Public,

“[SEAL.]

“New York Co., No. 18.”

BY MR. BARKLEY: The above answer is objected to for the reasons above stated. Counsel for Joly further says that the communication of July 6, 1895, in the file of the application of Joly involved in this interference, referred to by the witness in his answer to question 10, was in response to a letter from the Patent Office, dated Tuesday, June 18, 1895; that counsel for Joly has understood for ten years past that all communications sent by mail from the Patent Office are not sent to the post-office until 4 o'clock in the afternoon or later; that such communication, dated June 18, 1895, was probably received by the attorneys of record for Joly on Wednesday, June 19, 1895; that in the ordinary course of mails at that time the then attorneys of Joly could not have started a copy of the said communication or the communication itself from New York City to Messrs. Boult & Wade, their London correspondents, before Saturday, the 21st day of June, 1895; that Mr. Freeman informed the speaker in April, 1896, that they, Foster & Freeman, who were attorneys of record for Joly until April, 1896, had held no communication direct with Joly, a party to this interference, prior to the year 1896; that in view of all these matters, counsel is of opinion that the statements contained in the aforesaid communication of July 6, 1895, were never submitted to or approved of by Joly before the filing of the same or at any time thereafter; with the known times of getting letters to England and back, it is obviously impossible that the aforesaid communication of July 6, 1895, could have been sent to England and returned to the United States in time to be dated on the 6th day of July.

Q. 12. In answer to question 240 Hallock says, in reference to the McDonough specification in interference, that "it is not good scientific usage to refer to more than three primary colors in a spectrum." What have you to say in regard to this?

BY MR. BARKLEY: The question is objected to for the reasons above stated.

A. I produce a book entitled "A New Principle in Heliochromy," by Frederick E. Ives, author of "Isochromatic Photography With Chlorophyl," Philadelphia, printed by the author, 1889.

On page 3 Ives says:

"According to this theory, which is now accepted by all scientific authorities, there are, strictly speaking, hundreds of primary spectrum colors, but only three primary color-sensations. All color sensation is supposed to be due to the excitation of three kinds of nerve fibrils in the eye, one kind producing the sensation of red, another of green, and another of blue. One end of the spectrum affects only the 'red fibrils,' the other, only the 'blue fibrils.' The middle of the spectrum affects chiefly the 'green fibrils,' and intermediate parts affect two kinds of nerve fibrils simultaneously, in different degrees. When all three sets of nerve fibrils are affected alike, the sensation is that of white light."

Church says, page 67:

"Every ray of differing refrangibility in the visible part of the spectrum, is, in one sense, a primary color, for it is simple and excites a definite sensation." (See, also, Webster's Unabridged Dictionary.)

Q. 13. Joly in his answers to questions 47 and 53 refers to the "Joly Exhibit False Spectrum." What have you to say in regard to this exhibit?

BY MR. BARKLEY: The question is objected for the reasons above stated.

A. Joly says in answer to question 53 that he is not certain that the screen bound to make this exhibit is the same that was used in taking it, and in answer to question 54 that whether it were so or not is of no consequence, and in answer to question 53:

“My viewing colors are the same in all cases, being spectroscopically chosen, and the lines upon the cover screen at present on the picture being identical in width and spacing with those which originally serve to take the negative.”

I presume the screen is a viewing screen. The colors of the screen, which it is also intimated are the same used in taking the picture, are not “reddish orange, yellowish green and violet blue.” The red is one which has not the qualification of the one called for in the McDonough specification. This is easily seen by any one familiar with the spectroscopic examination of aniline colors. The red has an entirely different nature. The green is also a color with a different nature and is not called a yellow green by Joly. The whole picture, while in a measure conforming to the count, is presumably a picture made on and by one of Joly’s viewing screens and “false” as an illustration of the McDonough specification. The “Exhibit Joly False Photo. of a Girl” does not conform with the McDonough specification nor meet the requirements of count II, and is so defective in color and depth as not to merit consideration.

BY MR. BARKLEY: The answer is objected to for the reasons above stated.

Adjourned to Wednesday morning, January 6, at 9:30 o’clock.

CHICAGO, January 6, 1897.

Parties met pursuant to adjournment. Present as before. Examination of Mr. McDonough resumed by Mr. Banning.

Q. 14. Joly says in answer to questions 88, 92 and others that he has always used an ordinary ruling pen to rule his lines. In his answer to question 95 he says: "I had in my possession during that time, three pens similar to that which I have produced in evidence. With these three pens all the plates I have spoken of were ruled;" and in answer to question 90 he says: "I have never observed any difference in the densities of the color at opposite extremities of a line ruled across a plate, except, perhaps, under accidental circumstances." What have you to say in reference to this?

By MR. BARKLEY: The question is objected to as not being proper rebuttal.

A. In Joly's answer to question 134 he says:

"I have never found that the pens ruled lines of unequal depth when the ink supplied was good, and precautions to which I have alluded in the course of direct examination were attended to."

In answer to cross-question 135, which was, "Taking all of the pictures mentioned in my cross-question 133, are not the pigments spread on the screens thinner at their point of linear contact with each other than along their central portions?" Joly says:

"I cannot see the defect alluded to by examination with a strong lens; but I have noticed photographic effects which led me to believe that the lines to some extent acted as lenses. This need not introduce any error in the primary colors."

In answer to cross-question 149 Joly says:

“The wedge may lie in some cases along the boundary of the linear space defined by the line. I think this is partly to be ascribed to the lens action I have referred to, assuming that the deposition of the ink adjacent to a line already deposited gives rise to a certain prismatic form to the lens, the light being by this means slightly intensified to one side.”

In answer to cross-question 151:

“I can detect no difference whatever in the uniformity of depth of color of the line. I must therefore presume that the pigment contained in the ink is at least uniformly distributed, but I could not say what actions might occur in the absorption by the gelatine of the vehicle of the ink.”

And in answer to question 150, in regard to the cause of this lens effect, he says:

“I know of no satisfactory explanation. It may be due to the manner in which the ink dries upon the gelatin.”

It is a well-known fact that if a small drop of liquid be placed upon a smooth surface, or a narrow line of liquid be ruled upon a smooth surface, it would assume the form of a lens, thicker in the center and thinner at the edges. This is caused by attraction of cohesion. If Joly could rule a line of equal depth from edge to edge with his pens, one of the laws of nature would be eliminated. There would be no rain drops, the world itself would probably be of no shape. The color necessarily occupies the same relative thickness and dries in the form of a lens, whose edges must transmit a different predominant ray from that of the center. I have made an exhaustive examination of these lenses. I do not think that Joly has ever ruled a screen with pens whose transmissions

accord with the exact lines and curves which are necessary, as he says, and should agree with his exact tests of colors by the spectroscope. If his pictures be faithful, it is not necessary. He is entirely oblivious of this action. While forming his answer to question 151 he examined the lines with a lens to see if the depth of the colors were uniform.

BY MR. BARKLEY: The answer is objected to as immaterial and irrelevant, incompetent and not proper rebuttal.

Q. 15. Joly says in answer to cross-question 157:

“I know of no observations going to show that with changing intensities there are changing relative actinic effects produced by different colors. Under ordinary ranges of illumination it is, I think, certain that any such variation, if existing, would be negligible. The fact that in the Ives process different intensities of white can be reproduced is experimental proof that such variations are negligible.”

What have you to say in reference to this?

BY MR. BARKLEY: The question is objected for want of foundation and as incompetent, irrelevant, immaterial and not proper rebuttal.

BY MR. BANNING: Before the witness answers the question I will offer in evidence the book already produced by the witness, entitled, “A New Principle in Heliochromy,” by Frederick E. Ives, Philadelphia, 1889, and the same is marked “McDonough Exhibit Ives’ Heliochromy.”

A. I should say that he is not acquainted with the writings of Ives upon whose process he has founded his. Ives says in his book, “McDonough Exhibit Ives’ Heliochromy,” page 4:

“But the intensity of photographic negatives never

varies exactly as the sum of the light which acts to produce them, etc."

And on page 5:

"It is true that, owing to that defect in negative making processes which has already been mentioned, the most perfect reproductions will be made only from objects which do not present very great contrasts of light and shadow; but with suitable plates, exposure and development, there should be always a very close approximation to exact representation throughout every shade of the picture."

Ives recognizes that proper exposure and development of each of the three plates will be necessary to bring even a close approximation to a white.

Hallock says in answer to question 266:

"I would say that the proportion between the action of the light coming from the deep shadow upon the plate, and that from the high lights, would be practically the same."

And in answer to question 267:

"I believe that no change in the taking screen or its manipulation would be necessary."

(That is, if the object were photographed on an ordinarily bright day or an ordinarily cloudy day). Hallock says in answer 249:

"I have had no practice in color photography."

Both Joly and Hallock ignore this important question so necessary to the production of almost any kind of a picture of any degree of faithfulness. I have taken a great many pictures and have had a great deal of practice with tri-color screens. Taking a screen made in such colors as shall be fixed by accurate measurements to fit a certain photographic plate and a certain illumination, this screen or plate will not produce the same picture when a longer or shorter exposure is made necessary.

The preponderance of different colored lights in different parts of the day is recognized by Dr. W. H. Vogel of Germany, the inventor of orthochromatic plates, who says in Anthony's Photographic Bulletin, published in New York City, by E. & H. T. Anthony & Company, May 14th, 1892, page 262, commencing with "With regard to the application of color sensitive plates," and ending page 263 with "which all confirm the above."

By J. J. Acworth, Ph. D., F. I. C., F. C. S., where he says, on page 180, Anthony's Photographic Bulletin, March 25th, 1893:

"Again the necessity depends upon the predominant colors of the subject, and yet again, and in a still greater degree, on the quality of light lighting the subject, etc."

And closing with:

"A screen would be superfluous."

By Ducos-Du Hauron, in his French patent 83,061, 1868, where he says in effect at the sentence commencing "Pour que ceux-ci acquierent dans," etc.

"In order that these shall acquire in the same time the same degree of intensity, in spite of the difference of actinism of the rays which the three colored screens allow to pass, I retard the formation of certain of these negatives, notably of that which is furnished by the violet blue glass, by diaphragming more or less the corresponding lenses. The opening of the diaphragm should also vary according to the hours of the day, the light of afternoon containing less blue rays than that of the morning."

The question of change of relative actinic action of colors under different illumination is a serious one: A white object under different illumination from the same source will appear of very different hues when photographed under a tri-colored screen operated without ma-

nipulation. As illumination becomes lower, the picture will generally become bluer, or perhaps greener. As it raises, the picture will become redder or yellower. If the effect upon an orthochromatic plate were the same as upon the retina, it would be of no more consequence than the changes of light to the eye, but it is exaggerated to a great degree. On page 193 of Rood is a diagram with a label, Fig. 79:

“Three curves showing the action of the Red, Green, and Violet Nerves when stimulated by White Light of different degrees of Brightness.”

This diagram shows that the curve of red passes through the green and violet curves at a certain degree of brightness and then falls below them; and the violet curve passes through the red and green curves and raises to a higher point than either under a certain degree of brightness.

These curves show an approximation to an effect upon a sensitive plate, but there is a difference between the action of light upon the plate and retina. Red affects the nerve fibrils to a less degree in proportion than green or blue when illumination is lowered, and to a higher degree than green or blue when illumination is raised. I have almost always found it necessary to make what is in effect three separate exposures, one each for the red, green and blue violet lines, when I wanted a faithful picture. At times by accident the conditions will allow of a single exposure with a proper auxiliary screen such as Joly refers to in his specification. For some time past I have taken what may be termed three exposures at once and with a single lens, of course. In McDonough patents of 1892 occurs the following sentence:

“The use of the orthochromatic sensitive plates and colored screens before the camera for the pur-

pose of sifting light and regulating the action of different colors upon the film is too well known to require explanation."

Continued practice has shown that the actinic action of the different colors varies so much that it must be continually kept in mind and corrected by outside means, that is, the well-known auxiliary screens.

BY MR. BARKLEY: The answer is objected for the reasons last above stated.

BY MR. BANNING: I will here offer in evidence Anthony's Photographic Bulletin of May 14, 1892, and of March 25, 1893, from which the witness has quoted in his last answer.

Q. 16. Joly says in answer to question 27:

"The object sought to be attained is that beneath one of the minute areas on the taking screen the photographic plate shall be affected in the same manner as the red sensation nerve is affected by the various wave lengths of nature."

And in answer to question 28 he says:

"I know of no method involving triple or more manifold projections, or triple or more manifold subdivision of the image, which will reproduce nature's colors, except upon the procedure which I have enunciated with special regard to my invention of a subdivided image."

What observations have you to make on these answers?

BY MR. BARKLEY: The last objections are repeated.

BY MR. BARKLEY: The exhibits are objected to for like reasons.

A. There is a great difference between the action of light upon a photograph plate and the retina. The action upon the sensitive photograph plate is cumulative; the action upon the retina is not cumulative, because the

chemical substance which receives the stimulation or action (in what manner is not known) is constantly replaced. This substance is supplied to the retina in an approximately inverse ratio to the intensity of light admitted; that is, the more feeble the illumination, the greater quantity of "purpurine" is supplied. A photograph is not so supplied, nor is the silver acted upon removed and renewed as the chemical substance is in the eye. It is impossible for light to act upon a plate in the manner in which it acts upon the sensitive nerves of the eye. This necessitates the manipulation of the sensitive plates to change the colors of the screen while using. This result must be accomplished by other means than those that Joly uses. In the camera lengthened exposure means increased luminosity or intensity; in the eye it does not. The eye automatically adjusts itself to luminosity by the contraction of the pupil and the varying supply of "purpurine." All workers in this line, so far as I have learned, up to Joly's time (including myself), have made use of three separate exposures regulating the transmissions of separate colors as they pass to the sensitive plates. Du Hauron and those who have practiced his process for twenty-five years have done so as far as I know. A sensitive plate may be exposed to light from an object under a tri-color screen and only the red rays allowed to act, or the green or blue violet. They may be caused to act in varying proportions with increased transmission and in effect change of color. This is recognized by Abney. See page 199:

"It may be that the sensitive part of the retina is like a photographic plate, but with this essential difference—that the sensitive material is constantly changing. . . . Recent published experiments of my own have demonstrated that with a low intensity of light, the chemical change that occurs in a

photographic salt is by no means proportionate to that which takes place with a greater intensity."

Joly says in answer to question 157:

"But I know of no observations going to show that with changing intensities there are changing relative actinic effects produced by different colors."

By MR. BARKLEY: The answer is objected to for the reasons above stated.

Q. 17. Taking into consideration the facts given by you, and corroborated by the authorities you have quoted, in regard to illumination, the different action that takes place on the photographic plate and the retina of the eye, and the changing proportional action of different rays under varying illumination, what would you say in regard to a screen made to accord exactly with the sensation curves as laid down by, say, Koenig, with no manipulations to alter these curves to suit the variations explained?

By MR. BARKLEY: The question is objected to for the reasons above stated.

Recess for lunch.

A. I would say that it is absurd to make the statement that a single screen made in any colors will accord with the color sensations under the varying circumstances without manipulation, which means change of color in the screen, or that it is necessary to a faithful picture that these Koenig curves of sensation be accurately copied upon the screen, or to set a rigid standard of color of a certain density and infer that it is the correct and only one for a taking screen. The true taking screen is one that by the physical nature of the colors will allow the manipulations and exposures that will cause the impressions of light upon the sensitive photograph plate to follow these changes. These manipulations were long

known to those skilled in the art, but not to Joly. The density of colors is a matter of preference. The true viewing screen is of such colors as will practically reproduce the best and most faithful pictures. These are those of the McDonough patents of 1892, the Cross letter and my application in interference: reddish orange, yellowish green and violet blue of such depth as to answer the requirements of count II.

BY MR. BARKLEY: The answer is objected to for the reasons above stated.

In answer to question 38 Joly says:

“The photographic action would be confined to three separate and distinct regions of the spectrum, and the result would be that intermediate colors to those acting through the several areas of the screen would not be reproduced. The fact in this count is framed upon ignorance of the fundamental facts of color vision,” etc.

The above statement was made by Joly in answer to a question asking him about the result where a screen was used both for taking the negative and for viewing a positive made from the negative. What have you to say as to this statement of Joly’s?

BY MR. BARKLEY: The last objections are repeated.

A. My most natural answer would be that if the count were framed upon ignorance of color vision, that Joly should have withdrawn immediately from the interference and protested. Joly says in answer to question 46:

“The effect would be that the photographic action would be confined to three separate regions of the spectrum, and intermediate tints would not be reproduced.”

In answer to question 47 he reiterates this in regard

to my application in interference, and also at other intervals.

These answers are not correct in one sense and are entirely misleading. If an incorrect exposure were made, a picture could be made in which the spectral yellow and spectral blue would be omitted at the imaginary points of junction of red, green and violet in the photograph of the spectrum, but it is well to remember that this yellow and blue occur nowhere in nature uncombined with other yellows and blues, and are only separated so as to be visible to the eye by the spectroscope or some analogous method, such as the interference of thin plates, possibly. All colors of natural objects are complex, and the yellows of nature are composed so largely of red and green that even with such incorrect exposure a tolerably faithful picture will be obtained of this natural object, and valuable for commercial purposes. If the exposure is continued to a proper point, a correct imitation of the spectrum will be obtained. If Joly means that with a taking screen complying with count II no yellow or blue (intermediate shades) will be produced and the picture will be confined to red, green and blue violet, he is flatly contradicted by his own witness, Hallock, who says in answer to cross-question 259:

“ If a yellow object in being photographed, should send rays in proper proportion through the ‘ red and green ’ lines of a multicolored screen (each representing a fundamental color) in the process of being photographed, a yellow image would be produced by accurately superposing corresponding colored lines over the negative.”

And in answer to question 260, the same answer in regard to the intermediate blue.

The “ McDonough Exhibit Absorption Color Screens ” shows the action of yellow through both red and green

that mutually absorb each other. The glass plates should be placed over the paper plates, so that the length of the glass plates will be at right angles with the length of the paper plates.

Joly's ideas are not even theoretically correct, and I can find no evidence that he ever tried the process with screens made in accord with the screens described in the McDonough patent, Cross letters, or those of my application in interference. I cannot find by the testimony that he understands the underlying theories of colors or the properties of pigments. In "Joly's Exhibit True Photo. of Spectrum," which presumably is faithful and true, the lens effect is very visible, and by comparing it with the spectroscope it will be seen that the red is not at all the red of the spectrum; that there seems to be an entire absence of orange; that the absorption line D of the spectrum is not photographed.

BY MR. BARKLEY: The answer is objected to for want of foundation and as being incompetent, irrelevant and immaterial and not proper rebuttal.

Q 19. In answer to question 40 Joly said:

"It is quite legitimate to apply the terms of count II to my seeing screen. The colors required being the pure fundamental colors, so far as it is possible to attain to such."

What have you to say in regard to this and to your screens?

BY MR. BARKLEY: The last objections are repeated as to this question.

A. Joly says in answer to question 51 that a screen ruled in reddish orange, yellowish green and violet blue would not conform to the requirements of the count in issue. This answer is disproved if we accept his own testimony that with increased thickness of lines the trans-

missions will become more and more limited to the predominant transmission. It is easily proved by the tanks, paper card and color absorption screens that reddish orange, yellowish green and violet blue can be placed upon paper or glass sufficiently dense to accord with the requirements of count II. The witness Hallock says merely, in answer to question 240, that he believes it would be difficult in practice to obtain colored lines which will answer these requirements, and he believes they would not be suitable for successful color photography if obtained. Hallock says in answer 249: "I have had no practice in color photography."

Joly has one viewing screen which he claims as conforming to count II.

In my application of 1894, under consideration in this interference, there are nine or more screens described, of which a number conform to the terms of count II. The different screens described in my application may be described as follows:

"A screen with the particles of reddish orange, yellowish green and violet blue dusted upon it.

"A screen ruled in lines of reddish orange, yellowish green and violet blue.

"A screen with alternate dots or squares of reddish orange, yellowish green and violet blue."

Of these the depth of colors may be in accord with count II, or with those of Koenig or Maxwell. The nomenclature is identical with that of Joly (see question 103), and they will permit correct proportional transmission. For the purpose of using the taking screen as a viewing screen, or, as Joly puts it in his application in interference, "when it may be requisite to do so in order that one and the same screen shall serve for both taking and viewing the pictures," a very desirable point, I say,

“the color of each is preferably of such depth as to absorb the kind of light transmitted by both the others.” These screens are also described:

“A screen with more than three colors, such as the complementary colors, red and green, yellow and blue.

“A screen with the whole series of the spectrum.

“A screen where the width of colored lines may adapt itself to different degrees of sensitiveness to actinism.

“A screen where the depths of color shall adapt themselves to different degrees of sensitiveness to actinism.

“A screen of which the colors may correspond to the fundamentals, or, say, in reddish orange, yellowish green and violet blue.

“A viewing screen in lighter shades or tints in the same colors.”

I may say that a screen, the colors of which are of different depths to adapt them to different degrees of actinism, could not be well used as a viewing screen. It necessitates a screen of different colors from the viewing screen. It would not conform necessarily to count II. A change of hue is always consequent upon the change of depth of pigments. Rood says, page 270:

“But we are accustomed to see red when it is darkened recede from orange and approach pure red, or even, perhaps, to become somewhat purplish, and *vice versa*.”

On such a taking screen the red may be a thin orange, the green a full green, the blue a deep violet, with a mixture of yellow to aid in suppressing the ultra-violet rays.

BY MR. BARKLEY: The answer is objected to for the reasons last above stated.

Q. 20. In question 246 your fourth claim was read to Hallock. Such claim closes with the words “and transmit colors in ratio to the actinic action of the colors on

the sensitive photographic plate." In his answer Hallock says:

"I am at a loss to put upon this expression an interpretation consistent with the purposes for which the screen is intended."

What have you to say as to this? A. It will be seen by reading the specification that the ratio is an inverse ratio and should, perhaps, have been so distinguished for the benefit of those not skilled in the art, or those who do not wish to read the specification. That it is an inverse ratio would be known to those skilled in the art. Hallock is not skilled in the art.

Q. 21. In question 247 Hallock is referred to the brief filed by McDonough on the motion of Joly to dissolve the interference, and in his answer says:

"I would say that it is possible to select three colors, properly referred to as red, yellow and blue, which, when arranged as above stated, may present the appearance of a neutral gray."

What have you to say to this? A. In answer to cross-question 270 he avoids the following question:

"Do you mean by this to controvert the statement that red, yellow and blue (light), for example, will not produce a white light when mixed together, nor will they under any circumstances furnish a green?"

This statement was made by competent authority—"Ogden N. Rood, Professor of Physics, Columbia College, New York," where Hallock is "Adjunct Professor of Physics."

The colors Hallock would select would be "broken tints," and might be termed red, yellow and blue by courtesy or by one not very particular, but would not be so, nor answer the requirements nor description of the

specification. The answer would show a deficient nomenclature.

BY MR. BARKLEY: Counsel for Joly gives notice upon the record that Joly, at the hearing in this case, will produce a screen ruled in red, yellow and blue, which screen we have every reason to believe was made by the witness McDonough, and that such screen is gray; that counsel for Joly first saw the said screen as early as December 16, 1895, or thereabouts; that it formed part of a colored photograph of which there is an example among the McDonough exhibits introduced upon the deposition of Mr. Flora, numbered from one to seven.

Q. 22. In answer to cross-question 126 Joly says he would not say that a picture is worthless if it was a means of giving pleasure to intelligent people, nor unless it possessed defects which would be apparent to people of normal sight and intelligence. And in his answers to cross-questions 181, 182, 183 and 184 he gives his opinion as to the character of the picture that would result if the screen were ruled in the colors described in your application in interference, your 1892 patents and the Cross letter. If you take the criterion stated by Joly in answer to cross-question 126, stated in the first part of my question, how would the pictures made according to your 1892 patents, the Cross letter and your application in interference be regarded? And how far would the opinion expressed by Joly in his answers to the cross-questions referred to above be correct?

BY MR. BARKLEY: The question is objected to in so far as it relates to cross-question 126, the 1892 patents and the Cross letter and the answers of the witness Joly relative thereto, as irrelevant and im-

material and not proper rebuttal, and the same objection is made as to the 1894 application.

A. I would say that my pictures made as described have given great pleasure to everyone to whom they have been shown, and I think they would even if they did not accord exactly with the object from which they were taken, as paintings seldom do.

Adjourned until to-morrow morning, Thursday, January 7th, 1897, at 9:30 o'clock.

CHICAGO, January 7, 1897.

Parties met pursuant to adjournment. The witness, resuming his answer to the question, said:

Joly's answers to questions 181, 182, 183 and 184 are evidently based upon the assumption that the colors which are required by count II are opaque to radiations. This is impossible. It is a false assumption. It is against natural laws and facts. It is not required by either my specification or the count. These radiations at a certain intensity produce light. Below this intensity they do not affect the nerve fibrils. There is no light. This point where light and color disappear is where the colors are absorbed or cease in order to meet the requirements of count II. That these radiations, which do not affect the sight nor produce color, will, upon proper exposure, affect the sensitive plate, is a well-known and recognized fact. The theory upon which my negatives are formed is in accord with that of Young and Helmholtz. Rood says on page 182:

"It is remarkable that these changes take place with the PURE colors of the spectrum; but the explanation, according to the theory of Young and Helmholtz, is not difficult. Let us illustrate it by an example, taking the case of green light, which, as we have seen, acts most powerfully on what we

termed the green nerves, less powerfully on the red and violet nerves. Now, as long as the intensity of our green light is small, it acts almost entirely upon its own peculiar set of nerves; but, when the green light is made brighter, it begins to set into action also the red and to a lesser extent the violet nerves; the result of this is that the sensation of white begins to be mingled with that of green, all three sets of nerves being now to some extent in action. As in this process the violet nerves lag behind, the main modification of the color at this stage is due to the action of the red nerves, which cause it to appear more yellowish; hence it changes first to a yellowish green, then to a greenish yellow, and finally, if the light is very bright, to a whitish yellow. Corresponding to this, when red light is made very bright, the red and green nerves are set into action, the result being that the color changes in appearance from red to yellow. In this case the violet nerves play a secondary part, and their action merely causes this yellow to appear somewhat whitish. When pure violet light is made quite bright, immediately the green nerves begin to add their action to that of the violet, and the tint quickly changes from violet to ultramarine blue; the red nerves are soon also stimulated, and, in connection with the green, furnish the sensation of yellow; this yellow, mixing with that of the ultramarine blue before mentioned, gives as a resultant tint a whitish grey with a faint tint of blue or violet blue. The explanation of the changes which the intermediate colors of the spectrum undergo is analogous to that just given. The tendency in all cases is to the production of a yellowish white, or to a white, if the colored light be very bright."

The correct proportional transmissions are secured with a screen which will meet the requirements of count II, and by the same mode required by a screen ruled in less dense colors, or in accord with the Maxwell curves, that is, the use of a proper exposure and by the physical nature of the colors of the screen. That the correct propor-

tional transmissions are obtained by these colors is shown by underlying principles and actual practice more certain than any theory. A denial of this is a denial of the cumulative action of the radiations upon the sensitive photographic plate—a natural law.

I will describe the action which takes place when the picture is exposed in the camera under a tri-color screen. Let us take the diagrams given to represent the sensation curves. The ordinates represent the varying degrees of intensity of the action of the radiations at some assumed illumination. This action of the radiations from the object to be photographed is as follows: It must be remembered that the action upon the photograph plate is cumulative; that it takes time to accomplish a result and that this action will continue and increase until stopped or until the limitations of the plate are reached, and that in *any* photograph an under-exposure will not bring out details in low lights, and that an over-exposure will make a flat and worthless picture. Correct exposure is necessary and is always assumed.

The action of light commences at the top of the curves alluded to, and if the diagram be correct, in conformity with a section of the curve at the top. Each moment of additional exposure increases the width of the base line of this section of the curve. These base lines will at some time be joined, and after further exposure extend and overlap each other until stopped by closing the camera. By a prolonged or improperly long exposure with any set of lines ruled on a taking screen the curves will so overlap as to make an incorrect picture. The proper length of exposure in any and all cases is a matter of skill. The simple direction of my application in interference that “the color of each is preferably of such depth as to absorb the kind of light transmitted by both the

others," is directed to one skilled in the art who would test the colors of the pigments by the eye or spectroscope, and secure that density which will present to the eye the results called for. This is its simple design and undeniable meaning. The photographs introduced in the deposition of Mr. Flora as McDonough exhibits from 1 to 7 were made under my supervision or for me. Of numbers 2, 3, 5, the negatives were made by myself. Of numbers 1, 4, 7, the negatives were made by Mr. Flora in my presence. The negative of number 6 was made by Mr. Flora for me but not in my presence. All these, except number 6, I know to have been taken under viewing screens ruled according to my knowledge of the requirements of count II. That they are formed from the identical screens used for viewing under which they were made is not likely, but all these screens were ruled to conform with my application of 1894. We have found by this procedure that we can obtain more desirable pictures than by the use of more translucent screens. I think it will be readily seen that the lines ruled on the viewing screens of all these pictures are more dense than those of the screens used to form Joly's pictures, known as "True Photo. of Spectrum," "True Photo. of Girl," "Military Band Photo.," "Photo. of Mr. Dixon," "Photo. of Chinaware" and "Photo. of Uranium Bowl." Perhaps, barring some slight fading in the green in some of my screens which were made possibly a year ago; Joly says in his answer to question 40 that his viewing screens meet the requirements of count II.

Recess for lunch.

I wish to make a few comments upon my exhibit photographs. Exhibit No. 7 was made in Washington Park in this city a few days after a frost. In the foreground

are seen some lotus plants and lilies; in the center is a group of *Victoria Regias*; in the extreme background is a group of scarlet canna lilies; at one side are the photographs of two ladies who stepped before the camera when we made the exposure. Under the trees over their heads are seen a group of sisal plants; their peculiar bluish green will be noticed. The trees above them are slightly touched by frost. In No. 6 at the lower corner will be seen a policeman. This I have been told is an excellent portrait in every way. The color of the mail-box is faded, just as it is represented. The little boy sitting down has different colored tan stockings and shoes. Above him and back of him may be seen a climbing vine whose peculiar green may be noticed. The difference of the red of the brick chimney and cornice of the house will be noticed. The slate of the second story of the house is of a very peculiar formation. The colors are true.

Exhibit No. 4 is a blue vase which I painted myself, containing some artificial roses. A brass candlestick stands upon a book. In this candlestick is a candle which was lighted during the exposure and shows the colors of the flame. No. 1 is a picture of myself, upon which I will not comment, except to say that I wore a very dark red rose in my buttonhole and had on a white necktie with blue spots. This picture is, possibly a little faded.

Picture No. 2, of which a negative was made by myself, is accompanied by the chromo from which it was taken. The other pictures I will not comment upon in detail.

If Joly means by his answers to questions 181 to 184 that by the use of a screen made in accord with the requirements of count II a picture cannot be produced

which will be the means of giving pleasure to intelligent people with normal sight, he is utterly in error.

A viewing screen according with the requirements of count II it is admitted will make a faithful picture.

BY MR. BARKLEY: The above answer is objected to for want of foundation, as being incompetent, irrelevant and immaterial, and as not being proper rebuttal.

Q. 23. Do you understand that the subject-matter of this interference is limited to a screen or plate that will produce a faithful picture or true reproduction of the colors of nature? This question was asked of Joly as cross-question 130. Please give your views also on the matter.

BY MR. BARKLEY: The question is objected to for the reasons last above stated, and for the further reason that it calls for an opinion by the witness upon the scope of a claim.

A. According to my understanding it is not limited to a screen or plate that will produce a faithful picture, but for a screen or plate that will answer the requirements of count II, and the title of the application is "An Improvement in the Art of Producing Colored Pictures by the Aid of Photography."

I do not think the Patent Office ever asked for a perfect locomotive, sewing machine or photograph. I find from the evidence given by Joly that he does not think so, for he says in answer to cross-question 165, in giving his instructions to the skilled photographer:

"He may also elect, if he fails to be able to follow the principles of color vision or Ives' explanations, to be satisfied with a less accurate reproduction of color, when he will resort to a screen ruled in approximations to the recognized primary colors.

This screen may be used both for taking the negative and covering the positive."

In his answer to question 40 he says:

"It is quite legitimate to apply the terms of count II to my seeing screen. The colors required being the pure fundamental colors, so far as it is possible to attain to such."

That is, approximate primary colors.

BY MR. BARKLEY: The answer is objected to for the reasons above stated.

Q. 24. In cross-question 137 Joly was asked to give a definition of primary or fundamental colors and why they are so denominated and their physical characteristics. I will ask you to do the same. A. A definition of the primary or fundamental colors is:

"The fewest number of pure spectral colors which singly or in varying combination or by their total absence will produce the entire range of colors."

Abney says, page 24 of his book, and Joly assents, stating his answer to cross-question 139:

"As good a definition as any other of a primary color is that it is a color which cannot be formed by the mixture of any two or more colors."

If count II were founded upon ignorance of the fundamental facts of color vision, there could be no primary colors and these definitions would be false. The primary colors when they, to the eye or spectroscope, absorb each other, yet have the property of forming or producing the entire range of vision. They would not be primary colors if they stopped short, according to these definitions and in this sense. The primaries selected by Koenig are deficient in that they will not give the best yellows and intermediate colors, as already pointed out. The primaries

of Maxwell produce better intermediate shades, but not good. Those of Rosensteihl are somewhat deficient in the red, being described as an orange and not reddish orange. In my '92 patents, Cross letter and present application in interference, I have selected those which, when of sufficient density, will produce the best practical results.

Transmissions through these, with proper exposure and manipulation, will produce the entire range of color vision. The confirmation of the negative to the correct proportional transmissions is a matter of exposure or accordance of illumination.

By MR. BANNING: Before putting the next question I desire to notify counsel for Joly to produce the screen referred to by him in his statement following the answer to question 21, so that it may be exhibited to the witness to enable him to say whether it is one of his screens and to enable him to make any explanation that may be desirable in reference to it.

Q. 25. In cross-question 167 Joly was asked to state the particular class of men to whom he considered his specification addressed—possessed of what knowledge and theoretical or practical attainments. I will ask you to do the same with reference to your specification.

By MR. BARKLEY: The question is objected to as irrelevant and immaterial to the matter in issue and not proper rebuttal.

A. My specification is not addressed to scientists exclusively, but to those skilled in the art of producing colored photographs by the aid of photography. I did not intend to introduce any theories into my specification. I did not think that the Patent Office required theories. I understand that the law encourages brevity and not prolixity. I did not intend to teach the whole art of photography nor write a book on optics. I wrote plain

instructions as to the colors used to form the screens and the density preferred for a certain class of pictures and the uses to which these screens might be put. In speaking to such a one I would ask him to mix a yellow with a red or green to produce the colors I wanted, as in the '92 patents and Cross letter, and say "yellow," and not be apt to say, as Joly does in answer to question 39:

"I adopt this way of speaking of colors for the sake of simplicity. I might have said that some yellow should be transmitted in common through both the green-taking and red-taking areas. This appears to me to be, however, a more complicated way of explaining the matter, as the color yellow is to be ascribed simply to an excitation simultaneously of both the green and the red seeing nerves."

The directions in the '92 patents that as the mixture of red and green in a taking and viewing screen would not produce a good yellow (intermediate colors), and that it is necessary to add yellow to the red and green, is addressed to those skilled in the art, and is clearer to such than what means the same thing and is addressed to the scientists—that the transmissions must accord with wave measurements and theories. Any one skilled in the art would see that the instructions to use reddish orange, yellowish green and violet blue at a certain depth are explicit, and would more quickly instruct to accomplish a result with skillful manipulation, because the nature of the pigments allows the proper transmissions, and if they did not find the depth preferable they would use the alternative.

They would understand the question of exposure in the camera so that I could give no instruction, and if some exposure were not right, would correct it so as to obtain a faithful picture, using auxiliary screens well known to

all skilled in the art. Proper exposure is only acquired by skill.

They would know that positive pictures of many different values could be obtained from the same negative.

I would expect them to have a knowledge of Ducos-Du Hauron's colored photograph methods, which have been before the public for twenty years, and those of Kurtz and Ives, which have been before the public very fully for six years, or any other knowledge necessary to skill in the art, but not necessarily the full range of theoretic science.

BY MR. BARKLEY. The above objections are repeated as to this answer.

Q. 26. Were you present when one George A. Fowler gave his deposition in this cause and have you read his deposition since given? If so, please make such explanations and comments in reference to his statements in deposition as you may desire.

BY MR. BARKLEY: The last objections are repeated.

A. In reading the testimony of Fowler I find that he nowhere mentions the name of Ives. I do not remember any mention of Ives in the Joly application in interference. There were many others working on the problem of color photography, others had shown colors by the aid of the magic lantern. Joly repeatedly says that red, green and violet blue used to rule a taking screen will not make a faithful picture, for he says they will not transmit the correct proportional curves of sensation required by his method.

Fowler says in answer to question 202, in his description of the Joly method:

“A screen made of lines 200 to the inch on glass or some transparent substance, the lines alternating

with three primary colors—red, green and violet blue—placed before the sensitive plate in the camera.”

This is a taking screen and not a viewing screen. Fowler continues:

“The photograph being developed in the ordinary course, a corresponding screen of complementary colors being placed before the negative or finished photograph, with the result that a photograph of the original object would be produced, which to the human eye would appear in the varied colors and shades of color of the original.”

And in answer to question 205 he says:

“He told me that the viewing screen was made with colors different from those of the taking screen, but I have no recollection of his stating the precise colors used in the viewing screen. My recollection is that he used some such term as ‘complementary’ in that connection.”

The complementaries of these colors, red, green and violet blue, it is perhaps not necessary to say, are red, yellow and greenish blue; or in the case of other selections of reds, greens and violets, a blue-green, purple and yellow. See Hallock in answers to questions 262, 263 and 264. These colors for viewing have been used in the practice of the Du Hauron methods of 1868, and have been public for twenty years in combination with their complementaries. I will refer to the lecture of Professor J. Stewart Gibson, delivered before the Society of Amateur Photographers, on the 6th of March, 1896, and printed in “Snap Shots” of July, 1896, a publication printed by the Snap Shot Publication Company, 57 East Ninth street, New York. This lecture refers to the three-color process which is of the Du Hauron species, and on page 242 he says:

“In other words, the color of the light which

produces each negative is complementary to the color of the pigment printed by the plate made from it."

And on page 238:

"And when these are spread on a white surface, the result is practically the same as laying on the surface a very thin piece of glass having the same color."

If one skilled in the art were told the process imputed to Joly through Fowler by Trouton, he would undoubtedly accept it as some form of Ducos-Du Hauron's invention, and take the picture with a screen of red, green and violet blue, and view with a screen of red, yellow and blue, or purple, yellow and blue green.

It would not be a faithful picture or even an approximate copy of the original, but would certainly be a curiosity. Du Hauron used different colored screens for taking and composing his pictures in all his processes. I have known of Du Hauron's process since 1881 and have practiced it and given instruction to others, but I will say here that I knew nothing of the methods described in the French patent of 1868, commencing with the words "*autres manieres d'operer*," until about the 26th of March, of 1896. Du Hauron always used a different screen in making and viewing by preference. In the latter part of his specification of 1868 the yellow of the viewing screen is replaced in the sifting or taking screen ("*pellicule tamis*") by a greenish yellow—a distinction which shows that his viewing color was a yellow. He entirely omits the green, or any green, or even a greenish yellow, in his viewing screen.

BY MR. BARKLEY: The answer is objected to as incompetent, irrelevant, immaterial and not proper rebuttal.

Adjourned until to-morrow morning, Friday. January 8th, at 9:30 o'clock.

CHICAGO, January 8, 1897.

Parties met pursuant to adjournment; present as before. Examination of McDonough resumed by Mr. Banning.

Q. 27. In question 203 Fowler refers to pepper-caster screens, saying that an effort had been made on the part of someone to produce the same results by scattering the colors with pepper casters on glass placed before the sensitive plate, but that the impossibility of reproducing the position of the colors had made the process a failure. What have you to say on this subject?

BY MR. BARKLEY: The question is objected to as immaterial and irrelevant.

A. It is not an impossibility to reproduce the position of these colors. Spotted screens were patented in England by me in March, 1892.

Q. 28. Please examine the two transparencies marked "McDonough Exhibit Illustrative Transparency Gate Scene and Park Scene and Camera Screen" introduced in your deposition a year or more ago, and state what condition they are now in.

BY MR. BARKLEY: The question is objected to as irrelevant and immaterial and not proper rebuttal.

A. I have examined the two transparencies and the camera screen. The colors used upon the screens are faded to some extent, particularly in the green. This green is very susceptible to foreign influences. In this case it is largely caused by an accidental circumstance. The particular varnish I used about the time these were made spoiled a great many screens. This was not an immediate action, but took place gradually and perhaps has not reached its height of destruction yet. The camera screen was spoiled by a fracture and thrown in a waste

box, and fished out and placed in evidence at the request of Mr. Freeman, who then represented Joly. On account of this defect of fading, the two transparencies are not what they were when introduced more than a year ago.

BY MR. BARKLEY: The answer is objected to for reasons above stated.

Q. 29. Referring to the screens and paper printed for you in 1892, by Roberts, what have you to say further in reference to the colors employed?

BY MR. BARKLEY: The question is objected to for the reasons above stated.

A. They were all printed in lines. I always used a red, green and blue as near as possible to the fundamental colors when corrected for illumination by the mixture of yellow. These colors were within the range of fundamentals recognized by authorities. I used mostly inks of my own mixing, using an aniline green, and always in combination with yellow. Sometimes this green was printed upon the plate or sheet before the green which covered it, and at this stage the colors might be termed red, yellow and blue. I always used a violet blue or ultramarine blue. These cards and screens were printed about twenty days after the Cross letter was written.

BY MR. BARKLEY: The answer is objected to for the reasons above stated.

Q. 30. Why did you have the pictures, McDonough exhibits 1 to 7, and other exhibits introduced in the deposition of Flora?

BY MR. BARKLEY: The question is objected to for the reasons above stated.

A. I had the pictures introduced to controvert the repeated assertion of Joly that screens made in accordance with the requirements of count II, when used for taking

and viewing screens, would not produce valuable, pleasing or faithful pictures. The absorption color screens I had introduced to prove the reddish orange, yellowish green and violet blue could be placed upon screens in such depths as will meet the requirements of count II, and to controvert the statement of Joly that they could not be so placed. I had the color-mixing device introduced to prove that the primaries selected by Joly and Ives would not produce a faithful yellow, and in consequence that they could not make a faithful picture, and to controvert the statement of Joly that he and Ives could produce a faithful picture by strict adherence to the colors selected by them for viewing screens, and also to show the darkening and changing of hues produced in the picture by the arrangement of lines and the effects produced in the finished picture, and to show that my selection of primaries will produce a yellow of good intensity or illumination. I had the color tanks and cards introduced to prove that depth of color in reddish orange, yellowish green and violet blue could be obtained in accord with the requirements of count II, and to show the action of thinner and thicker layers of pigments in shifting and changing the predominant rays transmitted, and to controvert the statement of Joly in answers to questions 148 and 164. I had the "McDonough Exhibit 1892 Patent Screen" introduced to show that a spotted screen could be made in flat and even colors with no perceptible interstices.

BY MR. BARKLEY: The answer is objected to as incompetent, irrelevant and immaterial and not proper rebuttal.

Q. 31. When were the pictures, McDonough exhibits 1 to 7, inclusive, made?

BY MR. BARKLEY: The last objections are repeated as to this question.

A. Several of them were made, that is, the negatives taken, nearly a year ago. The picture of myself was made probably in June or July, 1896. The negative of No. 6 was made some time in August or September, 1896. The negative of No. 7 was made this last fall, just after the first frosts. I think the colored screens of which they are composed, with the exception of one, were all made more than a year ago.

BY MR. BARKLEY: The answer is objected to for the reasons last above stated.

Q. 32. Please state whether you detect that any fading has taken place in the colors since the screens were made? A. The greens in all of the pictures have faded to some extent, and to that extent the colors of the pictures are deficient. The fading of this green has been a great difficulty and I have spent a great deal of time and labor to obviate it. I have thought at times that I had overcome this difficulty, but the permanency of the color can only be decided by lapse of time and exposure to the different conditions. I have had some greens exposed to direct sunlight for, I think, two months, which I do not think have faded. But I think all of the screens that I have made have been susceptible in more or less degree to the action of light. This fading of the screens in the pictures of exhibit has not rendered them unpleasing. The picture No. 2 may be compared with the original chromo from which it was taken.

Q. 33. Look at the Joly exhibit pictures and compare them with your own, and state whether or not you find the colors in the Joly pictures lighter than those in yours?

BY MR. BARKLEY: The question is objected to as incompetent, immaterial and irrelevant and not proper rebuttal.

A. The hues of the colors used in my pictures are

different from those used in the Joly exhibits, and I think the question has been already sufficiently answered.

BY MR. BARKLEY: The answer is objected to for reasons last above stated.

Q. 34. In question 22 Joly was asked whether the invention described in your 1894 application in interference differed essentially from the invention described in your 1892 patents, and replied that, in his opinion, the specification differed essentially from the patent. Among other things he said that "the description of the colors is quite different." Please state briefly what you consider to be the facts in reference to this matter.

BY MR. BARKLEY: The question is objected to for want of foundation and the reasons last above stated.

A. The essential foundation of the two processes is the same. The description of the formation of the colors is different but the resultant colors are the same. A mixture of red and yellow will produce a reddish orange. The mixture of yellow and green will form a yellowish green. The blue described is the fundamental blue. Lines are not specifically mentioned in the '92 patents. The 1894 specification requires a different taking and viewing screen in the case of the use of any photographic plate of which I have any knowledge when it is required that the taking screen shall be suited to the color sensitiveness of the plate. The foundations of the two processes are essentially the same, that is:

"The selective qualities of multi-colored plates or screens upon the lights passing from an object to be photographed through them to the sensitized film in the camera and its subsequent development as a positive or negative."

BY MR. BARKLEY: The answer is objected to for the reasons above stated.

Q. 35. In answer to question 31 Joly stated that he understood count II in interference and said that "it means that the several vibrations transmitted through the areas of one color shall be absorbed by pigments covering the other areas." And in answer to question 33 he said that he thought that the count "clearly defines the meaning" that he has put upon it. What have you to say as to the correctness of Joly's interpretation of the count as given in his answer to question 31?

BY MR. BARKLEY: The question is objected to as irrelevant and immaterial and not proper rebuttal.

A. Count II is as follows:

"A screen or plate for photographic purposes, provided with different colored substances arranged according to regular recurring patterns—as dots, lines, figures—of such colors and proportions as to cause each to absorb such colors as are transmitted by each and all the others."

The word "vibrations" is not used in the count; it is not used in the third claim, which I wrote. I have carefully read the specification and I do not find the word "vibrations" anywhere contained in it. Color is distinct from vibrations. There are many vibrations below the red of the spectrum which are invisible. These vibrations are not color nor light, and are not referred to in the count as being absorbed. There is a long range of vibrations above the violet of the spectrum which is not visible. These vibrations are not color or light, and are not referred to in the count as being absorbed. Below a certain intensity no vibration is visible. These vibrations are not color or light, and are not referred to in the count as being absorbed. Above a certain intensity vibrations do not produce color, but a glare of light. These vibrations are not color in the strict sense of the term, and are

not referred to in the count as being absorbed. In the line spectrum, which is the spectrum of the sun, are many vibrations which do not affect the eye as color, and are not referred to in the count as being absorbed. The claim, specification and count refer only to such vibrations as will affect the eye to produce color or light. The meaning given to the count by Joly in answer to question 31 is a forced one. It is not a correct interpretation.

BY MR. BARKLEY: The answer is objected to for the reasons last stated.

Q. 36. In answer to question 35 Joly gave another meaning which he said the count might have if the *prima facie* meaning of the wording and other matters were ignored or not attended to, and in which he said in effect that the "predominating vibrations transmitted" through one pigment were absorbed more or less by the others. What have you to say as the correctness of the meaning of the count given by Joly in answer to this question?

BY MR. BARKLEY: The question is objected to for the reasons last above stated.

A. In view of my answer to the preceding question, the second meaning placed upon count II by Joly cannot be taken as correct. Joly still uses the word "vibrations" and does not confine himself to color. A screen made according to this second meaning will, of course, produce a picture, and is claimed in my application.

BY MR. BARKLEY: This answer is objected to for the reasons last above stated.

Q. 37. In answer to question 38 Joly said that if one screen was ruled both for taking the negative and viewing the positive "the photographic action would be confined to three separate and distinct regions of the spectrum," so that intermediate colors would not be reproduced.

What have you to say as to the correctness of this answer?

Recess for lunch.

A. I have already answered this question fully in my testimony. Joly says:

“The photographic action will be confined to three separate and distinct regions of the spectrum, and the result will be that the intermediate colors to those acting through the several areas of the screen would not be reproduced.”

The fact is that with a screen of reddish orange, yellowish green and violet blue, with proper exposure, correct proportional transmissions will take place. Joly's answer is not correct. Actual practice and experience show that photographic action is not confined to three separate and distinct regions of the spectrum, because blue and yellow are reproduced.

By MR. BARKLEY: The answer is objected to for the reasons stated above.

Q. 38. In answer to question 51 Joly said that a screen ruled in reddish orange, yellowish green and violet blue would not conform to count II in issue. What have you to say as to the correctness of this answer?

By MR. BARKLEY: The last objection is repeated.

A. This answer is not correct. It is proved incorrect by the “McDonough Exhibit Absorption Color Screen” and the “McDonough Exhibit Tank of Colors No. 2.” The colors may be ruled much deeper and more absorptive than these exhibits.

By MR. BARKLEY: The answer is objected to for the reasons above stated.

Q. 39. In question 79 Joly is asked whether the description that you give in your specification in interference is a sufficiently definite description or direction to

enable one to reproduce faithfully the colors of nature. What have you to say as to this?

BY MR. BARKLEY: The question is objected to for want of foundation and the reasons last above stated.

A. The question referred to refers to the colors used upon a particular taking screen as reddish orange, yellowish green and violet blue. The specification says that the colors reddish orange, yellowish green and violet blue are ruled or placed upon the face of the screen—in one case in separate fine alternate lines in colors in the order of the spectrum, and for a taking screen to be used as well for a viewing screen the color of each is preferably of such depth as to absorb the kind of light transmitted by both the others.

I find these directions are exceedingly explicit. Other screens are described in the specification, and I think in each case they are explicit.

BY MR. BARKLEY: The answer is objected to for the reasons last above stated.

Q. 40. I notice that the colors in some of the tanks in the "McDonough Exhibit Tank of Colors No. 2" have greatly changed since you put them in the tank last Monday. What is causing this change, if you know? A. I see in the bottom of the tanks containing the mixed reddish orange and the green and blue considerable of precipitation. There is some change in the color of the blue and the green has almost entirely changed its color, being almost red, one might say, in some parts. I think this change is due to the action of the zinc, of which the sides of each tank are formed, the colors having been left in the tank for about five days. I will produce some fresh bot-

tles of these colors to be placed on exhibition in the tanks at the time of the hearing.

BY MR. BANNING: I desire to offer in evidence book entitled "Snap Shots," from which the witness has quoted, and the same is identified as "McDonough Exhibit July, 1896, Snap Shots."

BY MR. BANNING: I now tender the witness for a cross-examination, but inasmuch as he has not been able to read over his testimony, he desires to reserve the right to do so and make such verbal corrections as he may consider necessary, though if counsel for Joly prefer, he may delay his cross-examination to give the witness sufficient time to read over and correct his testimony.

BY MR. BARKLEY: Counsel for Joly prefers that witness should make all of his corrections before the beginning of the cross-examination.

Thereupon an adjournment is taken until to-morrow morning, January 9, at 9:30 A. M., to enable the witness to read over and correct his testimony.

CHICAGO, January 9, 1897.

Parties met pursuant to adjournment. Present as before.

It is agreed by counsel for both parties that, in view of the change that has taken place in the colors in the "McDonough Exhibit Tank of Colors No. 2," such colors may be emptied out and thrown away and new colors produced by the witness during this examination and substituted in their place.

*Cross-Examination of McDonough by Mr. Barkley, and
without waiver.*

X Q. 41. In view of your statements concerning the state of your health, I wish to ask if you feel able to finish the cross-examination? A. I think I am. I hope to be able to go to the end, if the cross-examination is not unreasonably prolonged.

X Q. 42. Please produce all the typewritten and other written memoranda used by you during the course of your direct examination and from which you read your answers in whole or in part. Have you produced the said memoranda? A. I here produce and hand them to you.

X Q. 43. You have read all or parts of said memoranda as your answers, or some of them, or part of all of your answers, or part of some of them, to questions put to you by counsel, have you not?

BY MR. BANNING: The question is objected to as immaterial.

A. I have read a part of some of them. Maybe in some case all of one answer, but I could not tell that I have done so. I think all that part in my handwriting, or the most of it, was written after the questions were propounded by counsel. Some of the memoranda were not used at all that I remember.

X Q. 44. You have given me sixty sheets of paper, of which forty-three are typewritten, with occasional manuscript interlineations or additions. Seven of the sheets are upon letter-heads of an insurance company, of which F. L. Eastman appears to be agent, and ten are upon blank sheets of paper; the last seventeen named being in manuscript. Are you certain that there are all the memoranda called for by cross-question 42? A. I

think these are all that are called for and more than I have used in the examination. I tried to put in all the notes of any kind that I had on hand or have had during the examination. Two or three pages of these notes I brought here in my pocket this morning after the close of the direct examination.

BY MR. BARKLEY: Counsel for Joly offers in evidence the memoranda referred to in the last three cross-questions and the answers thereto, and the notary is requested to mark the same "Joly Exhibit McDonough's Prepared Testimony."

BY MR. BANNING: The offer of McDonough's notes and memoranda in evidence is objected to as incompetent, immaterial and irrelevant.

X Q. 45. What was your reason or what is your reason for postponing to your case in rebuttal the testimony you have given in this deposition concerning the nature, character and operation of the process or processes described in your application involved in this interference? And in your answer you may include your reasons for the like postponement of the testimony concerning the count in issue which you have given in this deposition.

A. When I gave my direct testimony on my former deposition I understood that nothing was necessary except to prove facts to show my priority in regard to the claims and specification which I had put in the Patent Office, or as specifically called for in the counts as then presented. I thought I was the original inventor of my process as then described, and in the three counts of the interference at that time before us. Since the taking of the direct testimony the interference has been reformed and two counts have been cast out. The Ducos-Du Hauron patent of 1868 has been discovered or brought to the

attention of the Patent Office. I did not have the benefit of that discovery which Joly has had. The affair has taken a turn which I could not foresee. Joly in his testimony has made statements which it is necessary to controvert by rebutting evidence.

X Q. 46. Is not the count in issue in the identical words it was when the interference was declared? A. Yes, I think it is.

X Q. 47. Please specifically point out the statements made by Joly in his testimony "which it is necessary to controvert by rebutting evidence." In answering this question you may give or refer to the statements called for as being contained in his answers to such and such questions by number. A. Referring to the printed copy of the Joly testimony, I will specifically point out the statements made by Joly and his witnesses in their testimony which, in my opinion, it is necessary or advisable to controvert by rebutting evidence. I will refer to the number of each question and answer to which I call attention, not attempting to quote anything from the question or answer. Questions and answers 9, 21, 22, 24, 27, 28, 29, 31, 33, 35, 36, 38, 39, 40, 41, 42, 43, 46, 47, 49, 50, 51, 52, 53, 55, 59, 60, 61, 67, 69, 70, 71, 73, 74, 79, 80, 86, 100, 101, 104, 112, 113, 129, 130, 131, 132, 134, 135, 143, 148, 149, 151, 157, 160, 161, 162, 164, 170, 171, 181, 182, 183, 184, 186, 188, 193, 202, 209, 227, 229, 231, 240, 241, 246, 247, 248, 265, 266, 267, 270. There are possibly one or two statements in these questions which have not been answered in rebuttal. They were overlooked.

X Q. 48. It has been said that "certain waves or vibrations which affect the fibres or rods of the optic nerve of the eye are translated by the brain into color;" that is, "color is an impression caused by the stimula-

tion in the eye of some apparatus that lies near the outer wall of the retina, the effect of the stimulation being conveyed by the optic nerve to the brain;" that "when these waves have a length of about 1-39000 of an inch, they produce the sensation which we call red—we see red light;" and in substance that, as vibrations of shorter and shorter lengths are successively projected upon the eye, the effect changes and we see the colors orange, yellow, green, blue and violet in succession, as well as a great variety of colors intermediate these; it has also been said that the number of colors "differing perceptibly from each other" reaches into the many thousands. Do you agree with the foregoing? A. I do not consider the foregoing to be a full statement, and as far as that it is not accurate. Authorities agree that below certain degrees of intensity vibrations do not produce the sensation of color and that above certain degrees of intensity they do not produce colors as distinct from each other; that is, the vibrations are so great as to produce nearly a white in all cases. The statement that there are thousands of colors in the spectrum is true, perhaps, but I do not think these thousands of colors have distinctive names. I will refer to Church, page 18, where he gives the names in common use to designate those of the spectrum and their proportions towards the whole. See diagram Fig. 4. Out of 1,000 parts, red, 149; red orange, 45; orange, 16; orange yellow, 20; yellow, 10; green yellow and yellow green, 104; green and blue green, 103; greenish blue, 48; blue and blue violet, 311; violet, 194. These are in the terms of the prismatic spectrum. I will also quote from page 19 the following:

"It should be added here that a part only of the visible spectrum is represented in Figs. 4 and 5, for

a dull red verging on brown or chocolate may be detected beyond the line A, while a dull lavender-grey extends beyond the line H at the violet end."

I will say that in the diffraction spectrum the reddish orange or orange red, as it is called in Church, on the same page, occupies more than twice in space the proportion that it does in the prismatic spectrum, being 104 parts, and the red occupies 330 parts—over twice that of the prismatic spectrum.

X Q. 49. In question 6 of this deposition you were asked a specific question about "faithful" pictures, and the possibility of producing such according to the Joly invention involved in this interference. In your answer to this question and others, which apparently do not call for such matters, you have made statements about what you have done, your experience in this work, etc.; what was your object in going into these matters?

BY MR. BANNING: The question is objected to as immaterial.

Adjourned until Monday morning, January 11, at 9:30 o'clock A. M.

CHICAGO, January 11, 1897.

Parties met pursuant to adjournment. Present as before. Cross-examination of McDonough resumed.

A. I thought it would be as well to make the answers show that I had experience and skill in this art, and had knowledge to make statements concerning it, and that I had made a long study of the subject.

X Q. 50. Please state briefly in your own words, first, what you understand a color sensation curve to be; and, second, how many such curves you understand there may be? In this, and all other questions not otherwise

expressed, you will understand that reference is had only to the normal eye. A. Young's theory, which I have taken as correct for the purpose of my specification, calls for three distinct sensations which affect three distinct fibrils in the eye. As the degree of sensation cannot without difficulty be represented by depth of shading to show the variations of these sensations, they are often represented diagrammatically by curves resting upon a base. The heights of ordinates denote the proportionate sensation. I understand there will be no more than three sets of curves to each diagram. What these curves will be depends upon illumination and other circumstances.

X Q. 51. You have said, "My invention is strictly founded upon a knowledge of color measurements and theories, which cover all points, according to the theories of Young and good authorities." First, who are the good authorities referred to? and, second, please explain in your own words and at length just how the matter referred to by you in the above quotation is founded on color measurements and theories, and how it covers all points. A. I consider Maxwell, Rood, Church, Rosenstiehl and Mayer as good authorities, judging by what I know of them. I would not say that I accord with every statement made by them, as they differ in some points. The knowledge spoken of is one which covers all points, according to the theories of Young and good authorities, that is, all points' requisite for this invention. The invention referred to is founded upon a knowledge or deductions from statements made by authorities upon the subject and in regard to color measurements and theories. It covers all points in that it has led me to provide a set of color screens ruled in such a selection of colors that by their physical nature they will automatically adjust themselves under proper manipulation so as to provide correct pro-

portional transmissions in accord with the general theory of Young. Color measurements and the theories advanced by authorities have led me to select these colors as the best to accord with practical use, always keeping the peculiarities of the process in view. The knowledge has been obtained by reading and experimental work with the spectroscope and the comparisons of photographs with the originals.

X Q. 52. Please observe the wording of the last question and make your answer more responsive thereto, if you can. A. I understand the matter referred to to be the invention. It is founded upon a knowledge of color measurements, for reasons already given, that is, measurements according to the theories of Young and good authorities. All points mean such as are necessary to produce a picture in accordance with Young's theory and good authorities upon Young. That such points are covered is assured by the fact that pictures are produced in which intermediate colors are reproduced. As I understand the question, it seems to me to be answered.

X Q. 53. You have said, perhaps with reference to the derivation of color sensation curves by various investigators, "The height of illumination selected by each investigator is arbitrary, and, for instance, is obviously different in the investigations of Maxwell, Koenig and Rosensteihl." On what authorities or printed publications do you base these statements? A. I do not know where I have seen the statement in regard to the selections of light used in these investigations. The results obtained show that it is so.

X Q. 54. To what results do you refer? A. The results obtained in the investigation of color sensation, and mapped, for instance, by Koenig, Maxwell and Rosensteihl.

X Q. 55. Referring to your exhibit "Absorption Color Screens," how thick are the colored glasses forming a part of the said exhibit? A. They are of the thickness of ordinary window-glass, that is, the glass upon which the pigments are placed.

X Q. 56. What is your understanding of the meaning of the count in issue in this interference?

Recess for lunch.

A. I understand the count to refer to a screen or plate for photographic purposes, upon the surface of which are arranged colored particles according to regular recurring patterns in dots, lines, figures. The colors and proportions of the colors are to be such as to cause each to practically absorb such colors as are transmitted by each and all the others—that is, under such circumstances as will ordinarily present themselves to the one using or making the screen. Commercially, one might not be able at times to obtain exactly this screen, but as long as the intent of the count is kept in view the screens would accord with the count.

X Q. 57. You have said:

"With a low illumination, either of the beam of sunlight used or a closer aperture of the spectroscope slit, only three colors can be seen, red, green and violet. At this point the color sensations coincide with the fundamentals, that is, with such conditions as will satisfy count II of the interference, and the proper diagram of the curves of the fundamentals is in accord with the sensations of the nerve fibrils."

Please make your statements above quoted more specific by locating the crests of the curves named upon the spectrum with respect to the Fraunhofer lines thereof. Also cite all authorities showing such curves with which you may be acquainted. A. I used the words "fundamentals" in a comprehensive sense to cover the pri-

maries selected by different authorities. Helmholtz says that the choice of the three colors is somewhat arbitrary. The heights of curves of the fundamentals by some authorities is as follows, approximately:

Helmholz.		Maxwell.	Rosensteihl.
Red,	C.	$\frac{1}{3}$ from C to D.	$\frac{3}{4}$ from C to D.
Green,	b.	$\frac{1}{4}$ from E to F.	$\frac{3}{4}$ from D to E.
Blue,	G.	$\frac{1}{2}$ from F to G.	$\frac{1}{3}$ from F to G.

These may be the heights of the curves of low illumination, or those selected from pigments. The fundamental color sensation diagrams are usually given in the terms of high illumination, such as sunlight, and of such diagrams there are many. Rood says that his results are the mean of fifteen to twenty observations. I do not remember any diagrams of the curves of low illumination and extinction as referred to by Church, Abney and Rood. A map of the curves of color might be some such one as "Joly's Exhibit Diagrams Illustrating Count," Fig. 1.

X Q. 58. What are the positions on the spectrum with respect to the Fraunhofer lines of "reddish orange, yellowish green, and violet blue of whatever depth, of which the effect upon the eye when they strike it simultaneously (in lines) is a white"? A. The positions on the spectrum would be approximately in the reddish orange from one-third of the distance between C and D to two-thirds the distance from C to D; for the yellowish green, from about one-third of the distance from D to E to about three-fourths the distance from D to E; and the violet blue, from about one-third the distance between F and G to one-fourth the distance between G and H.

X Q. 59. What are the positions on the spectrum with respect to the Fraunhofer lines of "reddish orange, yellowish green, and violet blue of whatever depth, of which the effect upon the eye when they strike it simultaneously (in lines) is a neutral gray"? A. A pure

white or a pure or neutral gray are the same thing. The same object, under different circumstances, will be a white or gray. I will quote Rood, page 133:

“It is evident that, if we give to the red and blue and green surfaces the proper proportions, we can from them produce white, or, what is the same thing, a pure grey.”

X Q. 60. Please explain in your own words how the linear areas of a sensitive film beneath the lines of a screen “ruled in reddish orange, yellowish green and violet blue of whatever depth, of which the effect upon the eye when they strike it simultaneously is a white or neutral gray” will necessarily be affected in manners corresponding to the manners in which (according to color measurement and theory) the red, the green and the violet sensitive nerves of the eye are affected by the various wave lengths of the spectrum.

Adjourned to Tuesday morning, January 12, at 9:30 o'clock.

CHICAGO, January 12, 1897.

Parties met pursuant to adjournment; present as before. Cross-examination of McDonough resumed.

Recess for lunch.

A. I wish to draw attention to the statement in application in interference that the colors of the lines of the screens are composed of aniline dyes to correspond with the fundamental colors of the spectrum, say reddish orange, yellowish green and violet blue. This gives a choice of any fundamentals, but specifies reddish orange, yellowish green and violet blue. The Cross letter of April 25, 1892, says:

“In case this yellow is not used the yellow must be added to the green and red, making as near as may

be expressed ultramarine, vermilion and emerald green."

This addition of yellow to a pure red and pure green will give pigments which may, in other words, be termed deep reddish orange and deep yellowish green, and undoubtedly changes the hues of the fundamentals known as pure red and green.

In answer to question 5 I have shown the shifting of the hues of the spectrum under changes of illumination towards the point of greatest excitation, and their recession when the illumination is lowered until extinction occurs in the intermediate vibrations.

In the answers to questions 6 and 8 I have shown the shifting of the predominant rays transmitted through pigments of the colors reddish orange, yellowish green and violet blue towards the point of greatest excitation or illumination, when the illumination is raised.

In answers to questions 15 and 16 I have said that the action of the vibrations of light upon the sensitive photographic plate is cumulative. This does not require proof and is well known. We sometimes make an exposure of from two to five hours in order to take advantage of this cumulative action. Photographs of stars are made which will probably never be seen by the use of the best telescope that ever may be constructed.

As illumination is raised, or time increased, the excitations are raised and the intermediate rays, which do not affect the eye as color, impress themselves upon the photographic plate, and naturally in the direction of the point of greatest illumination or excitation, which is near the yellow. There is no difference between the action of a "screen of ordinary illumination" and one of "high illumination," except that the screens of lower illumination allow of more time for accurate exposures. It has

been shown in answers to questions 15 and 16 that it is necessary to so regulate the different actions of the transmissions as to prevent undue predominance of any color. According to the doctrine of chromatic equivalents the excitation of the different fundamental rays should be equal to produce the sensation of white. See Church, page 73:

“ It follows that when all three kinds of nerve fibrils are equally and simultaneously affected, the complex sensation of white is alone produced.”

In raising from a low illumination to a higher, or by extended exposure, the impressions upon the photographic plate will extend themselves from the narrow limits of the contracted fundamentals to, for instance, ranges which will accord with the curves of Koenig, or to a point where all curves will overlap each other and the only sensations will be nearly white. These extended curves, as has been shown by authorities, are accompanied by the shifting of the predominant excitation towards the yellow. This is what is simply meant by the sensation curves of Koenig. It follows that with proper exposure the linear areas of the sensitive film beneath the lines of a screen ruled in reddish orange, yellowish green and violet blue of whatever depth, of which the effect upon the eye when they strike it simultaneously is a white or neutral gray, will necessarily be affected in manners corresponding to the manners in which (according to color measurement and theory) the red, the green and the violet sensitive nerves of the eye are affected by the various wave lengths of the spectrum. To expose a photograph plate under a screen made in accord with the curves of correct proportional transmissions, according to Koenig, will not produce a negative by magic. The exposure must be stopped and regulated. Light will not stop acting upon the plate *

when an exact exposure is obtained. It will continue. The point where the exact transmissions may be obtained is only to be reached by experience or skill with any screen in whatever color or depth of color ruled. The physical nature of the pigments, reddish orange, yellowish green and violet blue, as has been shown, allow this skill to be used, because they act naturally, as has been shown, and produce the proper curves when a proper degree of illumination or exposure is obtained.

I here produce a set of diagrams showing the excitation by the fundamentals under low, ordinary, medium and high illuminations, where these excitations equally affect the photographic plate. They are roughly drawn; the curves obtained should be nearly symmetrical. The horizontal lines represent the base lines. The continuations in dots below the base lines show the vibrations which are not of a degree of intensity to produce the sensations of color. The dotted verticals show approximately the point of highest excitation. They change their positions under higher illumination. The overlapping curves are shown as the illumination or exposure is increased.

By MR. BARKLEY: The answer is objected to as irresponsible and irrelevant to the question.

X Q. 61. You have, in your answer to question 6 of your deposition, passed some criticisms upon the faithfulness of the reproduction of color in "Joly Exhibits Military Band Photo." and "Photo. of Mr. Dixon." Please state what comparisons you have made of these exhibits with the originals thereof, and when?

A. I met Mr. Dixon in New York City in the month of March, I think it was, 1896. I have been in Canada, Ireland, Scotland, Wales and England; I have seen

thousands of British soldiers with red coats; I have looked at these pictures which are spoken of.

X Q. 62. I take it, then, that your comparison of the "Joly Exhibit Military Band Photo," with the "red coats" of the British soldiery is based upon what you remember of these "red coats" as you saw them in England, Scotland, Ireland or Wales. How long ago was it that you last saw the "red coats" in one of the countries named in this question? A. A good many years ago, perhaps twenty. My impression of those red coats are very vivid. I know they are nearly scarlet.

X Q. 63. Referring to your exhibit "Color Mixing Device," is it your opinion that the "good yellow" produced by rotating the disk carrying what you have called reddish orange and yellowish green is as bright as that of the yellow that would be formed in the eye by simultaneously presenting to the eye the same two masses of light, reddish orange and yellowish green, as you call them? A. I understand the comparison to be between two sections of the spectrum and the light from the pigments upon the exhibit. It is not as bright or as pure as the yellow formed by the spectrum on account of the impurities of the color and the reflected light from its surface. It is relatively as bright as it would be upon a screen containing the same pigments, barring the reflected light.

X Q. 64. Do you refer to screens viewed by transmitted or reflected light, or both? A. I mean by transmitted light. The general illumination of the exhibit is somewhat lower on account of its being placed upon paper.

X Q. 65. Please observe carefully the wording of the last question but one and make your answer responsive thereto, if you can. A. I do not consider the question

clear. I have answered it according to my understanding of it.

X Q. 66. What "effect of the fundamentals of Koenig" is it that is "destroyed" by the "lower illumination" referred to by you in connection with your exhibit "Color Mixing Device"? A. The illumination is lowered by the mixing of the black of the disk upon which the colors are placed with the separate colors. If we were to photograph this fundamental red or green, we would have a nearly opaque line on each side of the red or green on the pictures. This is the effect caused by rotating the disk. We could not get the fundamentals represented by the colors. This is a peculiarity of the process and a defect I have overcome by my selection of fundamentals. Rood says, page 187:

"Some of the changes in the experiments just mentioned were so great as to be quite astonishing, and might well tempt the beholder to believe that the black disk exercised some peculiar influence on the result; this, however, was not the case, as the same results can be obtained without the black disk by simply reducing the illumination of the colored disks by holding before the eye two Nicol's prisms, and turning them so as to gradually cut off the colored light."

X Q. 67. From the nature of your testimony thus far given, I infer that the fundamentals you have selected are somewhere between the *infra* red and the *ultra* violet of the spectrum; will you please give the place of each of the said fundamentals on the spectrum with respect to the Fraunhofer lines thereof?

Adjourned to Wednesday morning, January 13,
at 9:30 A. M.

CHICAGO, January 13, 1897.

Parties met pursuant to adjournment. Present as before. Cross-examination of Mr. McDonough continued.

A. I do not limit myself to any set of fundamentals. Those I have selected as the most practical are for the red about one-half the distance from C to D; for the green, about three-fourths the distance from D to E; for the blue, about three-fourths the distance from F to G.

X Q. 68. Please specify upon which of all your exhibits in this case, containing or consisting of transparent screens, the fundamentals referred to by you in the last sentence of your last answer will be found. A. The exhibits I will refer to are:

“McDonough Exhibit Broken Camera Screen.”

“McDonough Exhibit Illustrative Transparency Park Scene.”

“McDonough Exhibit Illustrative Transparency Gate Scene.”

Exhibits Nos. 1 to 7.

Screen made on Roller Ruling Machine.

Reproduction of May, 1892, Screens.

These are all transparency screens. These were all made, as near as it was practical to make them, to the fundamentals enumerated. I laid down instructions to my assistant, Mr. Flora, and selected the colors for the pigments with a spectroscope. I considered them sufficiently near when ruled. They are more or less faded, particularly in green.

X Q. 69. Referring to the second and third sentences of your answer to your cross-question 66, I understand that you mean that each area of red or green will have along side it an area twice as great of black, or nearly

black, and that the changes in hue, luminosity and purity in such cases, when viewed by a transmitted light, are properly illustrated by the rotating disk. Is this correct? A. They are properly illustrated. The construction is different. In the transparency the illumination is lowered by the lines on each side of the color. In the disk the black spaces occupy two-thirds of the space in the direction of rotation and the effect produced upon the eye is the same. In the case of the lines, the two black spaces are simultaneously received by the eye with the color. In the case of the disk, the rotation is so fast that the effect is exactly the same.

X Q. 70. Whence did you derive the first quotation contained in your answer to question 24? A. I found the definition from which I tried to quote upon page 237 of "Snap Shots." The definition here given is as follows:

"The primary colors are the fewest number of pure spectral colors which singly and in varying combinations with each other (or by their total absence) will produce the entire range of color vision."

I do not agree with Professor Gibson's selection of primaries as the only one.

X Q. 71. In your answer to question 24 you have quoted from Abney. Do you agree with his selection of the fundamental colors? A. I agree that Abney's fundamentals are one set of fundamentals, as I do with those of Professor Gibson as one set, and with Helmholtz and Maxwell and Rosensteihl.

X Q. 72. Do you agree with each of the persons named in your answer to the last question because their fundamentals all have some quality or property in common? If so, what is that quality or property? A. They all, I believe, have the property of producing white by a sim-

ultaneous mixture. They all, I believe, will produce the entire range of color vision, some better than others, as I have explained. There are three colors in each.

X Q. 73. What is there in common between the property "transparency" and the property "actinism"? A. Transparency is the property of allowing transmissions of vibrations. Actinism is the property of being affected chemically by vibrations. This, I think, is the general acceptance. As to the use of these two words in common, I could tell better if I knew what you meant.

X Q. 74. Please explain what you mean by "correct proportional transmissions," which I find in your answer to question 7. A. The words quoted occur in a quotation from Joly. By correct proportional transmissions I mean that the transmissions of vibrations are such that they will strike upon a photographic plate in the same proportion and proportionate degree of excitation that they would upon the fibrils of the eye.

X Q. 75. It has been observed that when one views three different thicknesses of a solution of the sesquichloride of chromium by transmitted light three different colors are seen, a green color when a thin layer is so viewed, a reddish color when a thicker layer is so viewed, and a deep red when a still thicker layer is so viewed. What is your explanation of the causes of these changes?

Recess for lunch.

A. The property alluded to is called dichromatism. Sesquichloride of chromium is shown as a curious example of absorption. The solution appears in thin layers as a kind of green because it transmits a quantity of vibrations which collectively we call green and a smaller quantity of the red vibrations at the end of the spectrum. It is said that the cause of the change of the color to the eye is that when the solution is thicker the green is absorbed

and the red, which is the last color to be absorbed, alone produces the sensation of color in the eye.

X Q. 76. What would you say is the predominating transmission in the case of a glass which appears to the eye to be a full purple? A. If I understand what you mean by a "full purple," the predominating transmissions would be both in the red and violet blue. I do not know that I ever examined a piece of glass for the purpose of finding this out.

X Q. 77. For what uses may the screens forming the subject-matter in this interference be put? A. The particular uses to which they may be put are the taking of photographs with their aid and the subsequent use in combining them with positive pictures to form colored photographs, or, in other words, taking or viewing photographs.

X Q. 78. Are there any other uses for these screens?

BY MR. BANNING: The question is objected to as immaterial.

A. It has been suggested that the screens may be placed before the lens of the camera to secure equal action of the different rays of colored light in connection with the taking of an uncolored photograph.

X Q. 79. Please state briefly how the most brilliant yellows would be reproduced to the eye by the use of a screen complying with the terms of the count in issue and used for both taking and viewing the photographs. A. A screen ruled in reddish orange, yellowish green and violet blue is used in the camera in contact with the photograph plate so that the transmissions pass through it to the plate. The conditions of the illumination should be observed and these transmissions so regulated as to cause equal action upon the plate by the several fundamental vibrations. An exposure must be given which will give

the effect of proper proportional excitation upon the eye. If the conditions enumerated are fulfilled this will occur when sufficient exposure has been given to secure good details. The negative obtained is used to produce a positive which is placed over and in contact and in proper register with a screen in reddish orange, yellowish green and violet blue. The most brilliant yellows will be produced if these instructions are carried out.

X Q. 80. You have simply given the mechanical steps that would be taken. Please explain how the yellows alluded to in the last question are transmitted to the sensitive plate in the camera, how they affect the plate and how the positive and screen reproduce those yellows to the eye. A. What we call yellow is the effect of the combined action of many vibrations of different wave lengths. These vibrations are transmitted by the red and green areas of the screen in proportions in which they affect the eye, but in a much lower degree of intensity—so much so that some do not affect the eye as color. These effects upon the photograph plate do not coincide with the effects produced directly upon the eye by the screen itself, but must be obtained by prolonged exposure and action upon the sensitive plate. The eye reproduces a new image continually. For this reason the transmissions of the pure yellow of the spectrum through the viewing screen may not affect the eye as color, and if we wish to reproduce them to the eye in the picture we must construct a screen which has the natural qualities of producing as good and saturated a yellow as possible. This cannot be obtained by using a screen ruled in the fundamentals given as full red, full green and full violet, because the vibrations of these lengths can neither reproduce the vibrations which cause the pure yellow nor a color in such purity or saturation as will accord with it, for the reason

that they lie too near the end of the spectrum and the vibrations are either too long or too short to affect the eye as the vibrations of the pure yellow do. To obtain a brilliant yellow, we must depart from these full fundamentals in the viewing screen and use one ruled in deep reddish orange, yellowish green and violet blue. It is a natural qualification of a taking screen in reddish orange, yellowish green and violet blue to transmit the vibrations which reach it in proper proportions, and they will affect the plate in proper proportions, all other things being correct. They allow the passage of vibrations through the separate areas in the manner which these vibrations affect the separate fibrils of the eye.

It is the natural qualification of a screen in reddish orange, yellowish green and violet blue to produce brilliant yellows by the combination of transmissions through the red and green. The positive and screen reproduce the yellows by the combination in various proportions of the transmissions of red and green through the screen and positive. Any violet blue which is transmitted only aids to produce a white which renders the yellow less brilliant.

X Q. 81. When did you first learn of the Maxwell diagrams and the Koenig diagrams referred to by you during this examination? A. I cannot tell. I see the Maxwell diagrams are contained in the "McDonough Exhibit Rood's Text-Book on Color," which came into my possession fifteen or sixteen years ago. I read the book through immediately. I think I have known of the Koenig diagrams at least four or five years—I am not sure when I first learned of them.

X Q. 82. Can you recall the circumstances under which you became acquainted with the Koenig diagrams? A. I cannot. I believe that Koenig and Von Helmholtz made a series of investigations together, but I have read

so much that I cannot recall the circumstances. The book of Ives published in 1889 contains the Maxwell curves.

X Q. 83. Do you remember the language in which the book was published in which you first saw the Koenig diagrams? A. I do not.

X Q. 84. When did you first learn of the book introduced in evidence in this case as "Joly Exhibit Koenig's Color System"? A. This German book I possibly saw for the first time when it was introduced.

X Q. 85. Then the only publications in which you have seen the Koenig diagram are the exhibits named in the previous question and the "Joly Exhibit Abney's Color Vision," are they not? A. No.

X Q. 86. Can you name any other publications? A. I cannot at present.

Adjourned until Thursday morning, January 14,
at 9:30.

CHICAGO, January 14, 1897.

Parties met pursuant to adjournment. Present as before.

Cross-examination of Mr. McDonough resumed by Mr. Barkley.

X Q. 87. I am not certain that I exactly comprehend your definition of "correct proportional transmissions." It may aid me in reaching an understanding of what you mean by the words quoted above for you to fully explain the reproduction of the spectral color at the D line by the use of the screens forming the subject-matter of this interference and complying with the requirements of the count; as a further aid, I ask that you make the explanation in connection with a diagram I hand you (a copy of the Maxwell diagram at page 104 of "McDonough Ex-

hibit Rood's Text-Book on Color"), referring for greater clearness to the reference numerals 1 to 10, inclusive, which I have marked thereon; in your explanation, please make it very clear just what part "correct proportional transmissions" play, and where and when. For the purposes of this question you may assume that the diagram is exact, that the "illumination" is the same as that under which the diagram was derived, that the exposure is the best possible, and that everything is done that one skilled in the art could do to get a perfect result. In a word, I want the scientific explanation of the thing, with all details relating to the mechanical steps and the like wholly omitted; also, you may omit all reference to the structure of the eye beyond reference to the "color-seeing nerves" thereof.

Recess for lunch.

A. I have produced a diagram in answer to question 60, which I shall name "McDonough Exhibit Curves of Excitations of Fundamentals Under Low, Ordinary, Medium and High Illumination," which will aid me in connection with the diagram submitted by counsel for Joly. In forming his diagram, Maxwell, according to account and custom, "employed an apparatus by which the pure colors of the spectrum could be mixed in any proportion." This necessitates the use of a spectroscope with its accompanying accessories. The illumination used is sunlight. A heliostat is employed in these fine experiments to direct a beam of sunlight through the spectroscope, and by the aid of machinery it follows the motion of the sun.

Rood says in regard to his experiments, page 23:

"The hues of the spectral colours change very considerably with their luminosity; hence for these experiments an illumination was selected such that it

was only comfortably bright in the most luminous portions of the spectrum, and this arrangement retained as well as possible afterward."

We view pictures by what I have termed "ordinary illumination;" we do not seek direct sunshine to view them by. We rule the screens by ordinary light. In order to accord with this state of affairs we examine the colors of the screen spectroscopically by ordinary light. Under these circumstances we obtain the depth of colors which are to comply with the requirements of count II in ordinary light, and form the colors which we view in the picture in ordinary light. It is assumed that the pictures and the screens may be viewed by ordinary daylight, in a room which may have a north view, and in which sunbeams never penetrate. Under these circumstances, the viewing screen is assumed to accord with the requirements of count II. A screen ruled under these circumstances, and which is in accord with the requirements of the count at the time when it is used for a *viewing screen*, is the screen called for by the question as a *taking screen*.

It has been proven and authorities given, in answer to question 5, that under increasing illumination the colors of the pure spectrum shift towards the point of highest illumination, and that as illumination is lowered the hues change and move backwards until intermediate transmissions become extinct.

It has been proven, and authorities given, that under increased illumination the predominant rays transmitted by pigments change or shift toward the point of highest illumination, and that at high illumination the pigment actually transmits other colors than those it does under ordinary illumination, that is, the illumination under which pictures are usually viewed.

It is well known that the action of vibrations upon the photographic plate is cumulative, and that invisible transmissions will impress themselves.

I will refer to my diagrams of excitations of fundamentals.

The actions of vibrations through a screen which complies with the requirements of count II are represented approximately by the curves. Fig. No. 1 represents the excitation at low illumination and the action of the different vibrations upon the photograph plate at the end of the first moment. Fig. No. 2 represents the action at the end of a second moment. Fig. No. 3 represents the action at the end of the third moment. Fig. No. 4 represents the action at the end of the fourth moment. Of course these periods of time are not supposed to be regular. The curves also represent approximately the changes which may take place in the colors of the screen during the raising of illumination to some certain point if the nature of the pigments of the screen is such as to allow of it. This is not necessary to the action of light in proportional effects, as a continued action of light will produce the results. It will be seen that the height of curves has raised and the curves extended into the adjacent areas, and moved towards the point of highest illumination. If this diagram of "Maxwell's curves" represents the effect that has taken place upon the photograph plate at this fourth moment, the transmissions have affected the plate in accord with the curves of the diagram.

Taking the case of the reproduction of the line D of the spectrum: In the screen, which is ruled in accord with the subject-matter of the interference, the point of junction in the spectrum of the colors transmitted by the red and green areas is placed as near as possible to the pure yellow, which has its place to the right of the D line.

The D line will be transmitted in a degree by the reddish orange area, as shown in Fig. No. 2 of the exhibit "Excitations of Fundamentals." As exposure is increased the transmissions would affect the photograph plate at some moment approximately as represented in Fig. No. 3 at the D line. At another moment, as represented at Fig. No. 3 at the D line. As exposure is further increased, the transmission would affect the plate as represented in Fig. No. 4 at the D line, which we assume is the illumination represented by the Maxwell diagram.

The spectral color D is not reproduced in the picture except in as far as it actually occurs in the reddish orange of the viewing screen, but what is lacking is represented by the mixing in the eye of all those transmissions of vibrations visible as color, and which passed through both the green and the red areas in proportion as shown between the figures 4 and 5 and 4 and 6 of the Maxwell diagram, which are ordinates represented by the line D. If we could accomplish exactly the same illumination as the sunbeam which was used in the investigation expressed by the Maxwell diagram by means of the screen, the screen itself would show the transmissions as represented in the diagram, but impurities and absorption prevent this. But even if they do not, the effect may be obtained by prolonged exposure. The illumination of the viewing screen is about one-third of that of the light producing the transmissions. I have already used a quicker way to explain the whole subject. The screens have the natural qualifications which are necessary to reproduce correct transmissions and by correct exposure the effect is obtained upon the photograph plate.

Without correct proportional transmissions and the corresponding effects we would get an approximate pic-

ture, lacking in some degree, but not utterly valueless by any means. Correct proportional transmissions mean that the red vibrations transmitted also pass by proper exposure through the adjacent area and that the green vibrations may also pass through the adjacent red and violet areas, etc., in such a manner as to affect a photographic plate in the manner that they affect the fibrils of the eye.

BY MR. BARKLEY: Counsel for Joly offers in evidence the Maxwell diagram referred to in the last question, and the notary is requested to mark the same "Joly Exhibit McDonough Rebuttal Diagram."

X Q. 88. Have you ever detected any purplish tinge in the reds used by you upon your screens? A. Not when they are ruled correctly.

X Q. 89. What chemicals or dyes were used in each of the solutions in the tanks in "McDonough Exhibit Tanks of Colors No. 2"? A. Pure chrysoidine, green S. N., quinoline yellow, and methyl or water blue, and yellow erythosin and fast yellow O. for the reddish orange mixture.

X Q. 90. What solvents did you use in each solution, and what are the proportions of the solvents and dyes in each case? A. The solvents are water, with a small quantity of alcohol to protect the solutions and prevent precipitation. The proportion of dyes to the solvents in each case was such as to produce a spectroscopic effect. The solutions were obtained by adding or subtracting or dilution of the mixtures to make them accord spectroscopically with the effect desired.

X Q. 91. Do the pigments upon your screens undergo any chemical or molecular changes except gradual ones extending over long periods of time? A. In the exhibit

screens I do not know of any molecular or chemical changes which are not gradual, except those caused by the varnish used to varnish the screens. They have been constantly fading, particularly the greens. That necessitates a molecular change.

X Q. 92. What is the cause of the long whitish lines upon the screen forming part of your exhibit No. 4, to wit, that containing the blue vase? A. The screens used in the seven exhibits are mica, and these lines are a separation of the very thin layers of mica at these places. Some mica splits like that and some does not. These white lines are invisible by transmitted light, I believe.

BY MR. BARKLEY: Counsel for Joly gives notice on the record that Joly at the hearing will refer to Chapter 3, entitled "Molecular Forces of Work," commonly known as Ganot's Physics, already named in the notice served in November last; also that he will refer to an article entitled "Orthochromatic Photography," beginning on page 587 of Vol. XLIV of the Journal of the Society of Arts, London, George Bell & Sons, 1896, said article being by Captain Abney; also he will refer to the reports of the proceedings of the "Photographic Convention of the United Kingdom," beginning on page 53 of the "Amateur Photographer," London, 1895, published by Hazell, Watson & Viney, Ltd.

Adjourned until Friday morning, January 15, at 9:30 o'clock.

CHICAGO, January 15, 1897.

Parties met pursuant to adjournment. Present as before. Cross-examination of Mr. McDonough resumed by Mr. Barkley.

BY MR. BARKLEY: Counsel for Joly, referring to the first sentence in the answer of the witness to question 18, desires to say upon the record that Joly, in the fall of 1895, as soon as he received a copy of the counts of this interference, drew up and properly executed an affidavit protesting against count II as being for an absurdity or an impossibility, or something of that general tenor. The said affidavit was forwarded to his then attorneys of record and was by them suppressed; that said affidavit is now in the possession of the present counsel for Joly and may be referred to by him upon the hearing.

BY MR. BANNING: Counsel for McDonough objects to any consideration upon the hearing or reference to the affidavit referred to by counsel for Joly, on the ground that the same does not constitute a part of the Joly record or of any other record, either in or out of the Patent Office, and suggests that if counsel desires to make any use of said affidavit it should be brought into the record in some proper way, so that McDonough and his counsel may have the opportunity of considering it and asking any questions about it that may appear to be pertinent or desirable.

X Q. 93. In "Joly Exhibit McDonough's Prepared Testimony" I find a typewritten page with the numeral "5" at its bottom; in the last line I find the words "or obviate" interlined in pencil, apparently after the word "correct;" in the eighth line from the bottom I find the

word "the" crossed out by pencil and the word "his" written or interlined above it; in the tenth line from the bottom I find the word "He" crossed out in pencil and the word "Joly" written or interlined above it. Are the interlineations or corrections above named and herewith shown you in your handwriting? A. They are in my handwriting.

X Q. 94. I note in your answer to cross-question 87 a statement that "a screen ruled under" certain therein-before-named circumstances, and which is in accord with the requirements of the count at the time when it is used for a viewing screen, is the screen called for by the question as a "viewing screen," and I beg to inform you that that question has no such fanciful meaning. Your answer to that question necessitates an indefinite prolongation of of this cross-examination.

The meaning of the word "absorb" is fixed and definite; it is defined as "To take up by cohesive chemical, or any molecular action, as when charcoal absorbs gases. So heat, light and electricity are absorbed or taken up in the substances into which they pass. Nichol." The foregoing definition is from Webster's International Dictionary; the same idea of *completely taking up* is to be found in "McDonough Exhibit Rood's Text-Book on Color," where he says a certain-named medium "is able to transmit" certain-named "rays, but it stops all the others; these last it absorbs;" nor does the count contain any limitations as to "exposures," "illumination," and other matter that you have brought into your answers; the word color is (in its primary sense) defined in cross-question 48, where the quoted statements are from Church, Abney and Rood; other meanings of the word "color" are "hue," "pigment" and "dye;" Joly defined proportions "to mean depths of color" (in sub-

stance), and you have accepted that definition; substituting these definitions for the corresponding words in the count, it would read as follows:

“A screen or plate for photographic purposes, provided with different colored substances arranged according to regular recurring patterns—as dots, lines, figures—of such hues (dyes) and depths of hue as to cause each (area) to stop or completely take up such vibrations as are transmitted by each and all the others.”

Do you accept the meaning of the count last above given? Let your answer be yes or no.

BY MR. BANNING: The question is objected to as indefinite and misleading and argumentative, and it is suggested to the witness that he should answer the question “yes” or “no” if it is susceptible of such an answer, and that he has a right to follow his answer with such explanations as he may deem necessary.

A. No. If we place a sponge in a basin of water or pour water through it, it will absorb what it can of the water—that is, what it is capable of absorbing and no more. These colors are only spoken of as capable of absorbing other colors. Nothing is said of vibrations. Only a certain limited range of vibrations are capable of producing the sensation of color. The medium spoken of by Rood in the quotation is ruby glass which has special qualities, and is not under consideration.

X Q. 95. Still, vibrations are what go through the screen, are they not? A. Yes. Vibrations of color pass through the screen. Other vibrations which do not produce the sensation of color also pass through, notably those of the ultra-violet and those of too small intensity to affect the eye as color.

X Q. 96. Excluding the infra-red and the ultra-violet

from consideration, what are the other vibrations that pass through and yet do not produce the sensation of color, and in what authority do you find any reference to them?

Recess for lunch.

A. All vibrations between the infra-red and ultra-violet may pass through without affecting the eye as color if their intensity is sufficiently reduced by the absorption of the screen. I refer to Abney as authority for saying that we may lose all sense of light by reducing the energy of the different rays, and that in a certain case there would not be enough energy transmitted to stimulate the red-perceiving apparatus sufficiently to give the sensation of light. I have seen the statement in some book of mine, which I cannot put my hand on at present, that a certain degree of intensity of vibration is necessary to produce the sensation of light or color; that these invisible vibrations do pass through a screen is proved by the fact that they affect the photographic plate. I refer to the general article in Abney upon the extinction of color and visibility of illumination.

X Q. 97. Still excluding the infra-red and ultra-violet from consideration, are you able to name any printed publication in which the photographic effects of these invisible vibrations are treated of or referred to?

A. I cannot say that I can refer to any such publication at present, as articles upon this subject may or may not exclude any infra-red and ultra-violet. I will refer to a work called "The Chemistry of Photography," by Raphael Meldola, F. R. S., published by McMillan & Company, London and New York, 1889, from which I make the following quotation:

"By means of highly sensitive dry plates the stars can now be photographed in their myriads—it is

only a question of mechanical perfection of adjustment in the driving gear which compensates for the earth's rotation, and length of exposure. Distant suns and nebulae too faint to be seen by human eye with the best of instruments, and so remote that their light may take years to reach the earth, can be made to record themselves faithfully on that surface which has been well described as 'the retina which never forgets.' "

There are stars which emit red, green or blue light.

X Q. 98. What is the "turn which you could not foresee" to which you refer in answer to cross-question 45? A. I think it is easy to see that as Du Hauron in his patent shows a system of color photography that perhaps covers in general transparent screens ruled in lines of certain colors, from which the colors I use differ, that I should explain specifically, in as far as is necessary for the requirements of the count, what my colors are and give the particular qualities which distinguish them from his. As I did not know of these screens of Du Hauron and named other colors than the ones necessary for the purposes of this count, and as I claimed a screen in any colors, I did not think it necessary to go into any particular philosophy. I wish to make this question clear as far as it relates to this count. Du Hauron never used a green, nor yellow-green, nor green of any kind, in his lined screens, nor such colors as would mutually absorb each other.

X Q. 99. Please state the names of your acquaintances and correspondents in Dublin, Ireland, and London, England, in the years 1893, 1894 and 1895. A. I do not remember any correspondence with any one during those years. I do not remember any acquaintances in Dublin or London, except such as might have been purely travelers. I do not think I know any one living in London or Dublin.

X Q. 100. Please state the names of your acquaintances who, according to the best of your information, visited London, England, and Dublin, Ireland, or either of them, during the years 1893-4-5, or any of them. A. Some of my acquaintances may have visited Dublin and London in those years, but I do not know of one who did.

Cross-examination closed.

BY MR. BANNING: I now offer in evidence the diagram produced by the witness and which he has termed "McDonough Exhibit Curves of Excitations of Fundamentals Under Low, Ordinary, Medium and High Illumination."

BY MR. BARKLEY: The above exhibit is objected to as immaterial and irrelevant.

Re-Direct Examination.

R-D. Q. 101. Have you produced bottles of the colors which were in the "McDonough Exhibit Tank of Colors No. 2," and which by agreement were emptied out? A. I have. Here they are.

BY MR. BANNING: The bottles produced by the witness are sealed with sealing wax and counsel for Joly requested to mark them, which he does.

R-D. Q. 102. Counsel for Joly has asked you about the preparation of your answers on the direct. Please explain why you wrote out your answers or made copious notes of them, and whether or not the answers were prepared by yourself or whether you had any assistance? A. I wrote these notes principally to save time. As an example of time lost in the preparation of an answer, I will refer to the answer to cross-question 47, for it took me, I think, a half a day to read the Joly record through carefully and give the number of each question in which

there were statements which I thought it was desirable or necessary to answer by rebutting testimony. Some other questions have taken me a long time to prepare where I was obliged to hunt up authorities. All references and quotations of authorities take a good deal of the notes. I prepared them entirely myself. I never showed them to my counsel.

R-D. Q. 103. How do you find the Du Hauron patent as to its describing two different screens, one for taking the negative and the other for viewing the picture?

BY MR. BARKLEY: The question is objected to as irrelevant and immaterial and not proper re-direct.

A. I find that he advises the use of a screen with a different color from his viewing screen, for a taking screen.

R-D. Q. 104. I notice that Hallock in answer to question 240, after speaking of your colors reddish orange, yellowish green and violet blue, says that these colors are not "generally accepted as the fundamental colors of the spectrum." What are the facts in regard to the transmission of fundamentals by your screens, color tanks and absorption screens?

BY MR. BARKLEY: The question is objected to for the reasons last above stated.

A. We cannot rule transparent colors upon a screen that will not change under different illuminations. On a dull day the picture made with a tri-colored screen is dull, lifeless and changed in color, and the cause is the changing of the colors of the screen toward a full red, full green and full violet. In ordinary light the picture becomes bright and true. When viewed by direct transmitted sunshine it becomes yellow in tinge, owing to the shifting of the colors. The colors of the screens, color tank and absorption screens change in varying illumina-

tion from the fundamentals known as full red, full green and full violet to fundamentals such as I have designated as reddish orange, yellowish green and violet blue, thus presenting a range which will cover all selections of fundamentals. This is the same with regard to the '92 screen and those of the Cross letter, yellow being added to both the red and green. A thicker layer of pigmentary colors or lower illumination of the screen, bringing approximate full fundamentals and thinner layers and higher illumination of the screen, reddish orange and yellowish green.

R-D. Q. 105. I notice in your specification in interference that you use the word "say" in one place immediately before naming your colors, so that the clause reads "fundamental colors of the spectrum, say reddish orange, yellowish green and violet blue." Why was the word "say" used?

BY MR. BARKLEY: The question is objected to as incompetent, irrelevant and immaterial and not proper re-direct.

A. Being well acquainted with the properties of light transmitted through the transparent pigments, I did not wish to exclude myself from any set of fundamentals, but wished to specify those that I found to be the best in the taking of a picture, and so used the word "say" to show that they were one selection, but not the only one that I could use. In another place I used the words "or an approximation to the recognized fundamentals of the spectrum," because I knew that various selections of fundamentals had been made and that these colors were approximate to any of the selections.

R-D. Q. 106. In color nomenclature what is meant by the word "pure"? A. I will quote from Church:

“The second constant of color is purity. A color is said to be pure when it is unmixed with white.”

A spectral yellow or orange are pure colors.

By MR. BANNING: I desire to give notice that I shall refer to and read from on the hearing the Joly files of application in interference and such books and publications as have been referred to by the witness in his direct and cross examinations.

Adjourned until to-morrow morning, January 16, at 9:30 o'clock.

CHICAGO, January 16, 1897.

Parties met pursuant to adjournment. Present as before. Re-direct continued by Mr. Banning.

R-D. Q. 107. I desire to call your attention to your answer to cross-question 94 and to ask you to make any additional answer or explanations to such question that you may desire.

By MR. BARKLEY: Question objected to as immaterial.

A. Question 94 says, “I beg to inform you that that question has no such fanciful meaning.” Church says in page 8:

“But in point of fact no bodies are perfectly transparent or perfectly opaque. . . . Thus, the sun may be conveniently viewed through a plate of glass which has been coated on one side with a thin film of pure silver, the light which passes through the metal appearing of a blue color, while the light transmitted through a piece of gold leaf is bluish green.”

It is not necessary that the screens should be more opaque than is necessary to absorb the colors transmitted by each and all the others when they are “viewed.”

The answer contains a reference to Joly's answer to

question 32 of his direct examination. I did not take exception to that answer, for he nowhere uses the word "vibrations," nor does the question itself. Understanding the word "hues" to mean "colors," I see no objection to the answer. The object set forth is that these colors should absorb such colors as are transmitted by each and all the others. Joly puts no fanciful nor forced interpretation that it shall be absolutely opaque to vibration, nor does he change the wording of the count to suit a purpose.

In my direct examination I tried to avoid the advancing of any theory in regard to the action of light in my particular process. I did not think it important what theories Joly or I had. I know that my theory is correct through means of repeated experiment and by the sanction of facts laid down by authority, but I did not think it should go into a patent. The counsel for Joly brought out Joly's theory in his direct examination and my theory in answer to cross-question 87 and elsewhere, and then in this question objects to it. I suppose now that all that is necessary is to find out who is the original inventor of a screen complying with the requirements of the count. I did not think it was necessary to inject any theory in my application which is in interference. There is no theory in Joly's application, as I understand it. Joly says that the colors he uses—reddish orange, yellowish green and violet blue, which are mine—for a taking screen are ruled to secure results according to wave measurements and theories. So my colors do, if ruled in the density required by the specification and with no different manipulation necessary from that required by Joly's in actual practice, except that longer exposure may be necessary which will give more latitude for proper exposure. It is sufficient to

know that if the explicit directions are followed a picture in colors will be formed. Let us use a rather worn but good example. The discoverer of the X-rays gave information as to the manner of producing them and called them X-rays because he did not know what they were nor how they acted. In addition, the discovery was accidental. Roentgen made the instruments public, others were ready to give theories. The X-rays are invisible and penetrate opaque substances and act upon photographic plates.

My directions are explicit for the purpose of the count. I cannot see that Joly's are. I assume one depth for a particular taking screen; Joly another, I presume. The same colors are used by both—reddish orange, yellowish green and violet blue. The depth given by me is to secure a screen to accord with the sensations at low illumination (according to color measurements and theories), for at this time they accord with the fundamentals, as I have shown. Joly has picked out some arbitrary point not named, but probably that of direct sunshine, as the depth for his accordance of sensation, but I cannot determine this by the specification. It is not necessary, to my mind, to say that these screens are to be ruled according to wave measurement and theory if a successful picture may be made when the directions given in the application are followed with skill and knowledge of the art. If one follows Joly's indefinite statement, the one ruling the screen must necessarily acquaint himself with the science and theory of color measurements and be able to practice it, which will preclude its use by anyone simply skilled in the art of making pictures by the aid of photography, because they form one of the most exact sciences, requiring the most exact measurement and a mean of normal eyesight.

It is tolerably easy to make a screen with my directions.

BY MR. BARKLEY: The answer is objected to as argumentative and immaterial.

Re-Cross Examination by Mr. Barkley, without waiver.

R-X Q. 108. Are you able to cite or refer to any authority or printed publication whatsoever which shows or refers to or describes any thing like or approaching the diagram "McDonough Exhibit Curves of Excitations of Fundamentals Under Low, Ordinary, Medium and High Illumination"? If so, name them. A. In regard to this diagram, Fig. No. 4 is an approximation to the Koenig diagram of color sensation. They all represent such excitations of the photographic plate as are required by the equal action upon the three nerve fibrils, to produce a white. They are the results of my own experience and I do not know that they are found in any publication. A somewhat similar diagram to Fig. No. 2 is found in "Joly Exhibit Diagrams Illustrating Count, Fig. 1." A somewhat similar diagram to Fig. No. 1 is found in "Joly Exhibit Diagrams Illustrating Count, Fig. No. 3." None of these figures are absolutely accurate; they are illustrative.

R-X Q. 109. When was the typewritten part of "Joly Exhibit McDonough's Prepared Testimony" made? A. About a week before the beginning of this examination.

R-X Q. 110. Did you use any notes or memoranda in the preparation of that typewritten matter of said exhibit?

BY MR. BANNING: Objected to as immaterial.

A. I did.

R-X Q. 111. When were the notes or memoranda so used prepared or made? A. Some of them were made

during the direct examination of Mr. Joly in New York City, last July. I made notes at different times until the opening of this examination.

R-X Q. 112. Are pigment yellows and oranges "pure" colors in the sense in which the spectral yellow and orange are pure colors? If your answer be in the affirmative, cite some authorities in support of your statement. A. They may be, as I understand it. I will quote from page 51:

"In a spectrum of the sun, or of any ordinary white light, as usually obtained by using a single prism, unless special precautions be taken, there will always be some white light. And in pigments and coloured objects the proportion that the white light bears to the coloured will often be much larger than we expect. The colours of vermilion, emerald green, and ultramarine are not pure in the sense in which this term is employed to designate one of the three constants of colour; for if we compare a strip of paper, painted thickly with vermilion, with the nearest corresponding colour of a pure and complete spectrum, we shall find that we can match its hue, but that it looks paler."

This is a comparison between prismatic colors and pigments placed upon paper. Quoting from page 80 of Rood:

"It would appear that at present it is actually possible to employ for woven fabrics dyes which furnish coloured light having a degree of intensity and purity which is actually undesirable. This is the case with some of the aniline dyes."

And in Rood, page 78:

"As has already been stated, when we obtain our coloured light from pigments it is apt to be more mingled with white light than when stained glass is used; but, besides this, it is inferior to that from stained glass in the matter of luminosity."

R-X Q. 113. The last question opens with the word "are" and not with "may be;" please observe the wording of the last question and make your answer yes or no if you are able. A. I understand they are. At least they may be made so by using the pigments of proper thickness.

R-X Q. 114. Have you ever heard that any of your acquaintances visited London, England, and Dublin, Ireland, or either of them, during the period of time covered by the years 1893, 1894 and 1895? A. I do not think I have.

R-X Q. 115. Do you know whether you have or not so heard? A. I do not know, because I might have heard somebody say that so-and-so had been in London in one of those years. I have had no communication farther than passing the time of day or some such thing as that with any of my friends whom I might have heard as having been visiting London or Dublin that I remember.

R-X Q. 116. Have you heard anybody say that so-and-so, that is, that any of your acquaintances had been in London or Dublin, or both, during the period of time covered by the years 1893, 1894 and 1895? A. I believe that I heard that Professor Crew was at the lecture given by Joly; I think the date was June, 1895. I became acquainted with Professor Crew, I think, some time in the early part of 1896. I cannot tell exactly when. I have so little acquaintance with Professor Crew that I am sorry to say that I would not know him on the street. We never corresponded. I doubt whether I knew him in 1895. I do not remember anybody else.

R-X Q. 117. Name each and all of your acquaintances whom you have heard say, or have heard anybody say of, that they were in London or Dublin, or both, during the

period of time covered by the years 1893, 1894 and 1895.

Recess for lunch.

A. I think that I have heard that Professor Hale and Professor Crew and Mr. W. J. Chalmers were in London during these years. I cannot remember any others now. I do not remember that I have heard that any friend or acquaintance had been in Dublin during those years.

R-X Q. 118. Let me aid your memory a little. You are acquainted with one Spencer D. Schuyler, are you not? Have you not heard that he was in England in the summer of 1895? A. I saw Mr. Schuyler this summer and I understood him to say that he had never been in England. If he was there in '93 or '94 or '95 I never heard of it. I am acquainted with Spencer D. Schuyler.

R-X Q. 119. Are you acquainted with one Frederick J. Harrison, and have you ever heard in any manner whatsoever that he was in England in 1895? A. I am acquainted with Frederick J. Harrison. I do not think that I ever heard that he was in England in 1895.

By MR. BARKLEY: Counsel for Joly gives notice upon the record that at the hearing Joly will refer to an article entitled "Color Photography" in the New York Herald of August 25, 1895, a newspaper published in New York by James Gordon Bennett. Counsel for Joly further gives notice that at the hearing Joly will use a microspectroscope and such other apparatus and things as he may deem necessary in investigating, demonstrating and illustrating the matter at issue, and the facts of color vision. Counsel for Joly further gives notice that at the hearing Joly will be prepared to demonstrate his whole process by taking one or more photographs of the spectrum according to his invention and process; that Joly will also take one or more photographs of the

spectrum through a screen, complying as nearly as may be with the count in issue, and will view the positive thereof through the screen used in taking the negative and through other screens coming within the terms of either application involved in this interference.

R-X Q. 120. In the box containing your exhibits, introduced upon your case in chief, I found last August, and find now, a small T-shaped device, consisting of a short metal rod with conical cavities in its ends, to which rod is attached a metallic penholder having the letter and word "E. Faber" thereon. What is this device? A. It is a device for holding an ordinary writing pen, which was at one time used in the "Exhibit Ruling Machine, September, 1893." It was afterwards altered to make it fit some intermediate machine by placing this cross-bar on it. Before that it had a straight rod through this hole in the flat part of it. It was at any time detachable from the machine.

Re-Re-Direct Examination.

R-D. Q. 121. I call your attention to the statement made by counsel for Joly at the end of your answer to question 21, and ask you to state whether the screens used in any of the pictures "McDonough Exhibits 1 to 7," introduced in the deposition of Mr. Flora, were ruled in red, yellow and blue?

BY MR. BARKLEY: The question is objected to for that the example spoken of, referred to in the question, refers to the photograph and not to the screen upon the photograph, and the question is therefore immaterial; that is to say, the screen referred to in the statement after question 21 was upon and formed part of a colored photograph of an

object, of which object there is an example among the "McDonough Exhibits 1 to 7."

A. The screens of the Exhibits 1 to 7 were all ruled in reddish orange, yellowish green and violet blue.

R-D. Q. 122. Counsel for Joly has asked you a number of questions, of which the apparent object has been to show that directly or indirectly you may have acquired a knowledge of Joly's process. I will ask you to state whether you ever directly or indirectly acquired any knowledge of Joly's operations or process that entered into the description of your invention or process, as described and claimed in your specification in interference, and whether such invention and process as described and claimed by you were the result of your own independent labors and operations.

BY MR. BARKLEY: The question is objected to as immaterial, argumentative and inconclusive.

A. The invention and process, as described and claimed by me, are the results of my independent labors and operations. I never heard of Joly nor his process, nor that he was working in this line, until I saw an article in the American Journal of Photography of December, 1894. Any knowledge gained from that article never influenced me in any way in making my application. I was ready to make my application before I read that article. I never learned anything from Joly.

BY MR. BARKLEY: Counsel for Joly gives notice upon record that Joly at the hearing may refer to an article entitled "Tints True to Life," in the New York World of June 25, 1896, a newspaper published in New York by the Press Publishing Company.

JAMES W. McDONOUGH.

STATE OF ILLINOIS, }
COOK COUNTY. } ss.

I, Annie C. Courtenay, a notary public within and for the County of Cook and State of Illinois, do hereby certify that the foregoing deposition of James W. McDonough was taken on behalf of the said McDonough, in pursuance of the notice and stipulations hereto annexed, before me, at the offices of Banning & Banning & Sheridan, 204 Dearborn street, Chicago, Illinois, in said county, beginning on the 4th day of January, 1897; that the testimony of said witness was continued from day to day as noted in said deposition; that said witness was by me duly sworn before the commencement of his testimony to tell the truth, the whole truth, and nothing but the truth; that the said testimony was written out by Laura C. Collins in my presence; that the opposing party, John Joly, was present by his attorney, Richard W. Barkley, during the taking of such testimony; and that I am not connected by blood or marriage with either of said parties, nor interested directly or indirectly in the matter in controversy.

In testimony whereof, I have hereunto set my hand and affixed my seal of office, at Chicago, in said county, this 27th day of January A. D. 1897.

ANNIE C. COURTENAY,
Notary Public.

[SEAL.]

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